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ABSTRACT

Developed for use by vocational agriculture teachers in Iowa, this instructional unit provides information about the growing and marketing of sod for lawns. This document is one of three manuals making up a single package. (The other two are Christmas Tree Production and Marketing and Sod Production and Marketing). The manual includes an instructional plan and related technical information. The instructional plan features objectives, interest approach, a listing of materials needed, and teaching procedures. The technical information section provides concise information related to sod production and marketing. A reference list is included for teachers wishing additional information on the topic. Transparency masters and activity sheets are provided and coded to the unit. A list of 10 slides for use with the instructional materials is also provided. Eleven fact sheets from the Iowa Cooperative Extension Service discuss various aspects of turfgrass care. (KC)

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Sod Production and Marketing

Instructional Materials Developed for Iowa Vocational Agriculture Teachers

Prepared by:

Departments of Horticulture and Agricultural Education
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Ames, Iowa 50011

June 1986

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5. Sod Production and Marketing	1986

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Forward

The growing of grass has been practiced by home-owners for many years; but in recent times, the demand for sod to create instant lawns for homes and commercial complexes has increased. This situation provides an opportunity for some people to become involved in the sod production business. Such developments provide an opportunity and a challenge for schools to include instruction on sod production and marketing in their vocational agriculture programs.

These instructional materials were developed for use by vocational agriculture teachers. They include an instructional plan and related technical information. The instructional plan features objectives, interest approach, a listing of materials needed and teaching procedures. The technical information section provides concise information related to sod production and marketing. A reference list is included for teachers wishing additional information on the topic. Visual masters (VM) and activity sheets (ACT) are coded with letters so they can be identified with this unit.

Slides illustrating various production and marketing practices and activities are included. The slides are not referenced in the materials. Instructors could use the slides to introduce the instructional area, to show a specific cropping practice or marketing activity, or review the topic.

Classroom/laboratory instruction on production and marketing of sod can be expanded for vocational agriculture students through leadership activities (FFA at the secondary school or PAS at the post-secondary school) and supervised occupational experience (SOE) programs. Involvement of students in contests, proficiency awards, and other leadership activities related to sod production and marketing can create student interest and enhance learning. The production of sod on a land laboratory, plots of land in the community, or land at students' homes may be appropriate SOE programs for some students. Marketing of sod may be a cooperative activity for a group of students. Some students may extend their learning by working on a sod farm or in a related business.

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Sod Production

Objectives

1. Identify the structures of the Kentucky Bluegrass plant.
2. List the steps involved in preparing soil for a new sod field.
3. Select good quality grass seed to be used for sod production.
4. Discuss the procedures used in proper seeding of the sod field.
5. Design a fertilizer program that promotes the production of quality sod.
6. Discuss the proper mowing techniques that encourage root growth.
7. Describe the process of harvesting sod to insure a quality product for marketing.
8. Demonstrate the three phases of installing sod.

Materials Needed

One flat of bluegrass or 6 inch square sod from lawn.
One flat of ryegrass or 6 inch square sod from lawn.
One flat of tall fescue or 6 in square sod from lawn.

Visual Masters

VM-SOD-1	Rhizomatous grass
VM-SOD-2	Stoloniferous grass
VM-SOD-3	Bunch-type grass
VM-SOD-4	Kentucky bluegrass
VM-SOD-5	Top view of Kentucky bluegrass with daughter plants
VM-SOD-6	Seed label
VM-SOD-7	Kentucky bluegrass cultivars recommended for sod production in Iowa
VM-SOD-8	Higher mowing heights favor roots and rhizomes
VM-SOD-9	Mow to remove no more than 30-40% in a single mowing
VM-SOD-10	Rotary and reel type mowers
VM-SOD-11	Harvesting sod
VM-SOD-12	Lightly moisten soil before sod is laid
VM-SOD-13	Laying sod
VM-SOD-14	Sod rolls should be laid perpendicular to slope and staggered in a brick-like pattern
VM-SOD-15	Staking may be required on slopes of 10% or greater
VM-SOD-16	Roll to insure good contact between sod and soil

Activities

ACT-SOD-1	Getting to know your sod
ACT-SOD-2	Consumer awareness
ACT-SOD-3	Content analysis
ACT-SOD-4	Planting depth experiment
ACT-SOD-5	Keep your grass green
ACT-SOD-6	Marketing sod
ACT-SOD-7	Sod installation
ACT-SOD-8	Sod placement

Interest Approach

1. Plant separate flats of Kentucky bluegrass, ryegrass and tall fescue several weeks in advance. A sample of each can also be dug from most lawns.
2. On a table or desk, place the three grass species.
3. Tell the students to identify the grasses and list the visible differences.
4. Begin a discussion on grass identification and adaption ranges. Topics to cover could include: species, cultivars, ligules, collars, wear resistance, recuperative ability, shade tolerance, and maintenance requirements.

Prepared by Nick E. Christians, Michael L. Agnew, and Gail R. Nonnecke, Department of Horticulture; and Susan L. Flanigan, Department of Agricultural Education.

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Teaching Procedures

1. Use VM-SOD-1, 2, 3, 4 and 5 and the sample from the interest approach to identify the structure of the Kentucky bluegrass plant. Explain the spreading growth habit, which allows for a tight-knit sod. To insure an understanding of the morphology, have students complete ACT-SOD-1 "Getting to Know Your Sod."

2. Discuss the steps involved in preparing soil for a new sod field. The steps that should be emphasized are tilling, smoothing, leveling and fertilizing.

3. Use VM-SOD-6 to discuss the contents of grass seed packages, as well as the selection of good quality grass seed. Have students complete ACT-SOD-2 "Consumer Awareness" and 3 "Content Analysis."

4. Use VM-SOD-7 to introduce the Kentucky bluegrass cultivars suggested for sod production in Iowa. Blends of two to four cultivars are recommended, to assure diversity in the turf.

5. Plan a trip to a local lawn care center or equipment sales operation to examine the various types of equipment used in seeding. Ask a salesperson to explain the advantages and disadvantages of each.

6. Discuss the proper procedures that need to be followed when planting grass seed. Hand out ACT-SOD-4 "Planting Depth Experiment." This activity can be done as a class or small group projects, depending on the equipment you have available. (Note: ryegrass is used because of its quick emergence (3-6 days), bluegrass takes 10-21 days).

7. Explain the importance of maintaining a carefully controlled fertilizer program. Once the grass has emerged, nitrogen becomes the most important fertilizer element. Have students complete ACT-SOD-5 "Keep Your Grass Green."

8. Use VM-SOD-8 to illustrate the effects of mowing height on root and rhizome growth. Using VM-SOD-9, discuss the proper mowing method to insure quality sod production. Use VM-SOD-10 to explain the different types of mowers and have students brainstorm to list the advantages and disadvantages of each.

9. Introduce the topic of harvesting sod with VM-SOD-11. Discuss proper cutting depth, transporting, and the length of time sod can be held in stacks. Have students complete ACT-SOD-6 "Marketing Sod."

10. Explain the steps in preparing the site which include: soil testing, cultivating and grading. Lead a discussion on sod installation using VM-SOD-12 and 13. Use VM-SOD-14 and 15 to illustrate the proper placement of sod rolls and stakes. Using VM-SOD-16, emphasize the importance of good contact between sod and soil. Have students complete ACT-SOD-7 "Sod Installation" and ACT-SOD-8 "Sod Placement".

Extra Suggested Activities

1. Seed the school athletic field and/or school grounds.

2. Care for school athletic fields and/or school grounds.

3. Develop FFA chapter project, Young Farmer activities or SOE projects involving sod production.

4. Invite a commercial sod producer to be a guest speaker. Discuss the day-to-day activities and decisions that are involved in growing sod.

5. Develop a small demonstration plot, comparing good quality seed to cheaper poor quality seed.

6. Sponsor a workshop for the community on proper lawn care maintenance.

7. Overhaul lawn mowers as a community service project or fundraiser.

8. Keep school lawn mowers in top working condition.

9. Take a field trip to a local golf course and have the greenskeeper discuss his/her responsibilities.

10. Conduct a lawn mower safety awareness program for the school.

11. Construct a lawn mower safety display for a local store front window.

Suggested References

1. American Sod Producers Association. Guidelines to Sod Specifications. 4415 W. Harrison St., Hillside, IL 60162.

2. Beard, J. B. 1979. Turfgrass: Science and Culture. Prentice Hall, Route 9W, Englewood Cliffs, NJ 07632.

3. Beard, J. B., H. J. Beard, and D. P Martin (eds.). 1977. Turfgrass Bibliography from 1672-1972. Michigan State University Press, East Lansing, MI 48824.

4. Beard, J. B., J. M. Dipaola, D. Johns, Jr., and K. J. Karnok. 1979. Introduction to Turfgrass Science and Culture, Laboratory Exercises. Burgess Publishing Co., 7100 Ohms Lane, Edina, MN 55435.

5. Grounds Maintenance. Kathy Copley, Editor; P.O. Box 12940, 9221 Quivera Rd., Overland Park, KS 66215.

6. Iowa State University, Cooperative Extension Service. Turfgrass, Lawncare and Sod Extension Bulletins.

Pm 491 - Sodding a new lawn.
Pm 93 - Lawn weed control.
Pm 1039 - Sod production in Iowa.
Pm 1040 - Turfgrass care for athletic fields.
Pm 1053 - Renovation of lawns damaged by fusarium blight.
Pm 1055 - Turfgrass renovation.
Pm 1057 - Maintenance fertilization of turfgrasses.
Pm 1063 - Turfgrass management calendar: Kentucky bluegrass lawns.
Pm 1067 - Which grass is best for your lawn?
Pm 1072 - Establishing a lawn from seed.
Pm 1113 - Calibration and maintenance of a fertilizer spreader and lawn area calculation.
Pm 1127 - Thatch control in the home lawn.
Pm 1213 - Mowing your lawn.

Write to: Publications Distribution, Iowa State University, Ames, IA 50011.

7. Turf News: A Publication of the American Sod Producers Assoc. 4415 West Harrison St., Hillside, IL 60162.

8. Turgeon, A. J. and F. Giles. 1980. Turfgrass Management. Reston Publishing Co., Inc., Reston, VA 22090.

9. Weeds, Trees and Turf. Bruce F. Shank, editor; 757 Third Ave., New York, NY 10017.

For More Information Contact:

American Sod Producers Association, 4415 W. Harrison St., Hillside, IL 60162.

Technical Information

Introduction

In the production of sod, a mature grass cover is produced in an intensively managed agricultural operation and is removed intact, with a minimum amount of soil, to another location where it is transplanted to form an instant turf cover. The primary market for sod is the housing industry and the greatest demand for the product is in metropolitan areas. Shipping is expensive and proximity to a ready market is important. The demand for sod can vary greatly depending on activity in the housing industry and overproduction can be a serious problem for producers. The local market should be researched carefully before sod production is begun. However, where a ready market exists, sod production can be a profitable business or a profitable addition to an existing farming operation.

The production of a sod crop requires specialized equipment and a firm knowledge of production techniques. The goal of sod production is to grow good quality sod in the shortest possible time. Good quality means a dense, uniform turf with dark green color and sufficient root and rhizome structure to hold together during cutting and transplanting. The following unit will provide basic information on the production of sod, but the art of producing a quality sod crop can only be learned through experience and training.

Classification

Rhizomatous and stoloniferous grasses are the only species that can be used for sod production (see VM-SOD-1 and VM-SOD-2). Bunch-type grasses such as ryegrass will not form a sod that can be harvested (see VM-SOD-3).

Kentucky bluegrass (Poa pratensis L.) is the only grass species with desirable sod characteristics that will grow well in Iowa and is the only species recommended for sod production in Iowa. Tall fescue (Festuca arundinacea Schreb.) could potentially be produced with sod netting, but this requires very specialized equipment and techniques and should not be attempted without expert help. Creeping bentgrass (Agrostis palustris), the species used on golf course greens, could also be produced; however the market is very limited.

Morphology

Kentucky bluegrass can be identified by its boat-shaped leaf tip that resembles the keel of a boat, by the folded configuration of its newly emerging leaves, and by parallel translucent lines along the midrib of mature leaves. The rhizomes, (underground stems), of Kentucky bluegrass give it the spreading growth habit and allows it to form a tight-knit sod (see VM-SOD-4 and VM-SOD-5).

Planting Establishment

The best time to establish a sod field in central Iowa is between August 15 and September 15. In southern Iowa, satisfactory results may be obtained as late as September 30. In northern Iowa, September 15 may be too late in some years. Seeding can take place in spring or summer, but irrigation is generally required for seeding at these times.

Soil Preparation

Preparation of a new sod field should always begin with a soil test. Soil testing determines if phosphorus (P) and potassium (K) are present in sufficient quantities for the production of sod and it also will determine if lime is needed. If P and K are low, or if lime is required, these materials should be incorporated into the seedbed at the rate recommended by the soil testing laboratory before seeding. Lime is particularly difficult to add after the turf is established, and should be added during soil preparation.

Tilling is the first step in soil preparation. This can be done by plowing the area and then disking, or by rototilling with a tractor-mounted tiller. The bed should be tilled 4 to 6 inches deep. Next, the area should be smoothed with a harrow, a drag, or some other land-leveling device. The goal is a level, firm seedbed. Heavy rollers should not be used during soil preparation. Rolling may compact the soil excessively

and lead to compaction problems later.

Phosphorus is the most important fertilizer element at the time of establishment. It is recommended that a starter fertilizer, one with a high level of phosphorus and a moderate level of nitrogen, be applied directly to the soil surface at the time of seeding. This should be done even if the soil test level of phosphorus is in the high range.

Materials with an $N\text{-}P_2O_5\text{-}K_2O$ analysis of 13-25-6, 18-46-0, or 15-26-6 are well suited for this purpose. They should be applied at a rate equal to approximately 45 lb P_2O_5/A. With the 13-25-6 material, which is 25 percent P_2O_5, 180 lb of fertilizer would have to be applied/acre to achieve this rate.

Seed

Only good quality Kentucky bluegrass seed should be used for sod production. There are many loopholes in the laws which govern the labeling of grass seed. As a consequence, there is grass seed on the market of inferior quality that is not suitable for sod production. Buy from a reputable seed dealer. Bargains are very rare in the turfgrass seed industry and consumers generally "get what they pay for". Always read the seed label carefully before buying any seed (see VM-SOD-6).

Cultivars

There are many cultivars of Kentucky bluegrass available. The cultivars chosen can be a very important factor in the final quality of the stand. Iowa State University recommends that a blend of from two to four cultivars be used in sod production. Blends assure diversity in the turf. Some cultivars show tolerance to certain diseases and environmental conditions, whereas others show tolerance to different diseases and different conditions. If such diversity is present, it is unlikely that a single disease or stress will eleminate the entire stand. Cultivars recommended for sod production in Iowa are listed on VM-SOD-7 This is not a complete list, and it is sure to change as research continues. But it does contain many of the Kentucky bluegrass cultivars that have performed well in the Midwest over the past few years.

Seeding rates vary somewhat with time of seeding and soil type. Recommended seeding rates of Kentucky bluegrass for sod production in Iowa range from 30 to 45 lb/acre. Seeding rates in excess of 45 lb/acre rarely result in improved sod production. On a fertile soil that is to be seeded in late summer or early fall, the lower rate should be sufficient. If the field is to be seeded in the spring, or if the soil is sandy, the higher rate should be used. These are general guidelines. The best seeding rate for a given area should be based on the experience of the grower.

The seed can be applied with many different types of equipment. Drop spreaders and rotary spreaders are the most common types, but even airplanes have been used to apply seed to sod fields. After the seed has been applied, a cultipacker should be used to assure seed-soil contact. Machines which combine a drop seeder and a cultipacker in one unit are commercially available. They are very effective and recommended for large sod operations.

Uniformity of seed application is of the utmost importance. The most uniform application can be obtained by dividing the required amount of seed in half. Spread one-half of the seed in one direction over the field, and then spread the other half at right angles to the first application. This will help eliminate the problems of overlapping and of bare areas that often occur with seeding in a single application.

Irrigation

Irrigation is not required for sod production in Iowa and many sod farms produce sod without supplemental irrigation. Irrigation usually helps decrease the time involved in sod production. Eleven to 24 months are generally required to produce a mature Kentucky bluegrass sod in Iowa. In a year with above average rainfall, sod could be seeded in September and harvested the following August without additional irrigation. Usually, however, two seasons are required without irrigation. With irrigation, sod can be harvested regularly in 11 to 12 months.

Fertilization

It is well known in turfgrass science that excessive quantities of nitrogen fertilizer favor shoot growth at the expense of root growth. A carefully controlled fertilizer program is very important in the production of quality sod. A heavily fertilized sod field may look good on the surface, but may have a very poor root and rhizome system underground. Excessive fertilization not only increases the cost of production through increased fertilizer cost, but also may increase the time required to produce a sod that can be harvested. Table 1 contains a recommended fertilization program for sod production in Iowa. The program begins at the time of seeding and extends through the first production year.

Table 1. Recommended fertilization program for sod production in Iowa.

Time	Rate lb /Acre
at seeding	45 lb P_2O_5 and 20-30 lb N
1-1 1/2 inch height	25-30 lb N
April-early May	25-30 lb N
early June	25-30 lb N
3 weeks prior to harvest	30-35 lb N
September (for sod not harvested)	45 lb N

Fertilization at the time of seeding has been previously discussed in "Soil Preparation". After the grass has emerged, nitrogen becomes the most important fertilizer element. Whether to use P

and K in the fertilizer program depends on the soil test. In many cases, nitrogen fertilizer without additional P and K is sufficient.

When the grass reaches a height of 1 to 1 1/2 inches, apply 25 to 30 lb N/acre. This should be sufficient fertilizer to carry grasses seeded in late summer through the fall season. Fertilization should provide sufficient nitrogen to keep the grass growing without overstimulating aboveground growth. The program in Table 1 is designed to do this. The 25 to 30 lb N/acre applications in spring and in early June may not produce the highest quality sod from a visual standpoint, but will produce a sod with a strong root and rhizome system that will hold together at harvest.

The 30 to 35 lb of N/acre applied approximately 3 weeks prior to harvest is timed to improve the visual quality of the sod without adversely affecting root growth. If this application is made too close to harvest, damage during transport due to an increase in temperature within the sod stacks may occur. This is known as "heating" and can result in death of the grass. Sod which cannot be harvested in the first season (usually the case in non-irrigated fields) should be fertilized with 45 lb N/acre in September. The same program outlined in Table 1 should then be resumed in the following spring. Again, these are general recommendations. Irrigated fields or fields with sandy soils may require slightly higher rates. The exact rates are a management decision and should be based on grower experience and soil testing.

The Nitrogen source to use is also a decision of the grower. Water soluble materials such as urea or ammonium nitrate will work but there are indications that the controlled release N materials favor root growth.

Mowing

Mowing, like fertilization, can be managed to favor root growth. Excessively low mowing heights are detrimental to root growth, whereas higher mowing heights favor a healthy root system (see VM-SOD-8). Through most of the season, the sod should be maintained at a higher mowing height, 3 to 3 1/2 inches. High mowing heights near harvest time will add to heating, so mowing heights should be decreased slowly to approximately 2 inches by harvest. Scalping, due to abrupt decreases in mowing height, is detrimental, so the height of cut should be reduced gradually during the weeks prior to harvest. As a rule, no more than 30-40 percent of the aboveground growth of the turf should be removed in any single mowing (see VM-SOD-9). Reel or rotary mowers can be used for mowing (VM-SOD-10). Reel mowers are generally recommended because of the more uniform cut provided by this type of mower. Reel mowers are also considered to be safer to operate because they do not throw debris as rotary mowers do.

Weed Control

The annual grasses, particularly crabgrass and foxtail, are a serious problem in Iowa sod fields. These species can be controlled by preemergence herbicides applied in early spring, prior to weed seed germination. Broadleaf weeds such as dandelion and plantain may also present a problem. These weeds are controlled by postemergence herbicides such as 2,4-D, triclopyr, MCPP,and dicamba. The postemergence herbicides are most effective when applied in fall, but this is not always possible in sod production. Postemergence herbicides can be applied to Kentucky bluegrass sod anytime after the third mowing, but be careful to avoid drift to neighboring areas and avoid application when the temperature is high. For more recommended uses, see the ISU extension publication Pm-930, Lawn Weed Control. Always be sure to read the entire label before using any pesticide.

Disease & Insect Control

Turfgrass disease problems are not common in Iowa sod fields and the use of fungicides is rarely recommended. The grower may experience some problems with rust diseases on Kentucky bluegrass sod, but the problem generally can be eliminated through fertilization and mowing.

Turfgrass insects are not usually a serious problem in Iowa sod fields, although bluegrass billbugs and white grubs have been reported. The preventative use of insecticides in sod fields is not recommended, except in areas where severe insect infestations occur regularly.

If disease or insect problems are suspected, contact your local county extension director for information on identification and control.

Sod Harvesting

There are a number of sod harvesting machines available. They range from small, walk-behind units to large machines which can be mounted on a tractor. The type and size of machine to use will vary with the size of the sod operation. If more than one acre of sod is to be produced, it is recommended that the machine purchased be equipped with a vertical knife to automatically cut the sod strips into uniform lengths.

A common mistake among inexperienced sod producers is to cut sod too thick. Kentucky bluegrass sod should be cut at a depth of from 0.5 to 0.75 inch (see VM-11). Cutting the sod at this depth severs the rhizomes. A rhizome which has been cut will readily send out new roots. Sod that is cut too thick will be excessively heavy to transport, will remove too much soil from the area, and will not root as quickly as sod cut at the proper depth.

The sod can be stacked for transport in rolls or in strips. The method used will depend to some degree on personal preference and on the type of cutter used. There does not appear to be any great advantage to using one method over another.

The length of time that sod can be held in stacks before transplanting will vary with temperature. When temperatures are very high (90°F and above), sod should be cut and transplanted the same day. Under more moderate temperatures, sod can usually be held safely for 36 hours. Sod harvested when temperatures are cool can often be held for up to 3 days.

There are many other details, such as the proper operation of equipment, involved in the business of sod production that cannot be covered in this guide. These aspects can only be learned through experience and training.

Marketing

The primary market for sod produced in Iowa is the housing industry with the largest demand in metropolitan areas. Proximity to a ready market is important because shipping is expensive and sod can be damaged if not installed promptly. The demand for sod can vary greatly depending on activity in the housing and construction industries. Overproduction of sod can be a serious problem for producers. The local market potential should be researched carefully before sod production is begun. However, where a ready market exists, sod production can be a profitable business or a profitable addition to an existing farming operation.

To establish and maintain an excellent reputation for a quality product, only sod with the following quality characteristics should be sold: uniform, dense, dark green color, good tensile strength (to hold sod together when cut). Remember that sod should be harvested at thickness of 0.5 to 0.75 inches.

Installation

The installation of sod is a three phase operation. The first phase involves the proper preparation of the site to be sodded. The second phase is the actual installation of the sod. The third phase involves the care of the sod once it has been laid.

Site Preparation

The site preparation is the most important phase in the establishment of a lawn. Once the lawn is established, there is very little that can be done to rectify problems with the site. There are two steps in the preparation of a site. The first step is the preparation of the soil. Soil preparation must first begin with the removal of all construction debris from the site. This is then followed by properly grading the area. Grading is done by first stockpiling all of the topsoil and then grading the area to obtain at least a 1 percent, and no more than 20 percent, slope away from the building. Care should be taken to prevent low areas where standing water may collect. After the land is properly graded, the soil should be cultivated to a 6 to 8 inch depth. This will help alleviate the compaction that occurs during construction. The stockpiled topsoil should now be spread back onto the site to a depth of 6 or more inches. It is a good practice to till 2 inches of the topsoil into the upper 2 inches of the subsoil. This will help prevent the formation of soil layers which may interfere with soil water drainage. When the topsoil is spread on the site, the area should be allowed to settle prior to establishing the final grade.

When the final grade has been established, a soil sample should be taken. Collect soil samples at a depth of 3 inches from at least 15 locations in the area. Mix the samples and send a one-half pint sample to your county Cooperative Extension Service or a reputable soil testing laboratory. The test reports will indicate the pH, phosphorus, and potassium levels. It is important to incorporate the recommended quantities of fertilizer to a depth of 4 to 6 inches. Where soil tests are not taken, apply 10 to 15 pounds of 15-15-15 or 15 to 20 pounds of 10-10-10 per 1,000 square feet and work it in to a soil depth of 4 to 6 inches.

The final grade should be firm enough to prevent foot prints of more than 1/2 inch. Several rainfalls will aid in the settling of the soil. Rake the seedbed to give a 1/4 to 1/2 inch deep loose, granular soil.

Sod Installation

Sodding is the quickest way to establish a new lawn. It can be done almost any time of year when the ground is not frozen or covered with snow.

Just prior to laying the sod, an application of starter fertilizer high in phosphorus should be applied. It is also important to lightly moisten the soil (See VM-SOD-12). Be sure to avoid overwatering.

Sod pieces should be laid so that the ends of sod pieces are staggered as if you were laying bricks (see VM-SOD-13 and VM-SOD-14). This prevents long lines across the turf caused by slow establishment at the edges. Care should be taken to insure that the edges of the sod are in contact with each other. Avoid overlapping the sod or stretching the sod. Overlapping creates an uneven appearance to the lawn, while gaps will commonly develop when stretched sod begins to dry. On slopes, start laying the sod strips from the lowest part of the incline toward the building. On severe slopes, it may be necessary to peg the sod strips with wooden stakes to prevent slippage (See VM-SOD-14). Three, 6 to 8 inch stakes per sod strip are usually adequate. One stake should be placed at each end and one in the center. Stakes should be driven through the sod vertically near the top edge of the sod strip after it is in place.

The newly laid sod should be rolled to remove air pockets under sod strips and to firm the sod against the soil as in VM-SOD-15. Use a light, 60 to 75 pound roller. Too much weight may cause sod to slide. In hot weather (above 85°F), the sod should be lightly watered prior to rolling. This will help hold the sod until adequate moisture can be applied. Thoroughly water the sod immediately after rolling. Be sure that water penetrates the sod pieces and moistens the soil to 6 to 8 inches deep.

Post-Installation Care

The sod will require daily afternoon watering for the first 7 to 10 days. During warm weather, the sod may need watering twice a day. Apply enough water each time so that the sod and the soil remain moist and cool. Sod should be knitting to the soil in about 10 to 14 days. At this point, deeper, less frequent watering should be practiced to encourage a deeper, healthy root system. Do not overwater new sod. Sod that is kept saturated will not root properly.

After laying sod, mowing should begin when the grass starts to grow. The recommended mowing height for bluegrass sod is 1 3/4 to 2 1/4 inches during cool weather and 2 1/4 to 2 3/4 inches

during summer stress periods. For best results, never cut more than 30% to 40% of the exposed growth at any one mowing (VM-SOD-9).

Once the sod is rooted, follow a fertilization program suggested for established lawns. Generally, four fertilizer applications per year are suggested for higher quality lawns. For additional information on lawn care, see the Iowa State University Cooperative Extension publications and others listed under suggested references.

The Iowa Turfgrass Producers and Contractors is an organization composed primarily of persons interested in some aspect of sod production or marketing. If you are involved in the sod business or are considering the sod business, you may want to join. More information about this organization can be obtained from your local county extension office or from the horticulture extension office at Iowa State University.

Glossary Terms for Technical Information

Bunch-Grass - Grass that does not spread by rhizomes or stolons.

Cultivar - (Derived from "cultivated variety"). International term denoting cultivated plants that are clearly distinguishable from others by any characteristic and that when reproduced (sexually or asexually) retain their distinguishing characters. Cultivar is synonomous with variety.

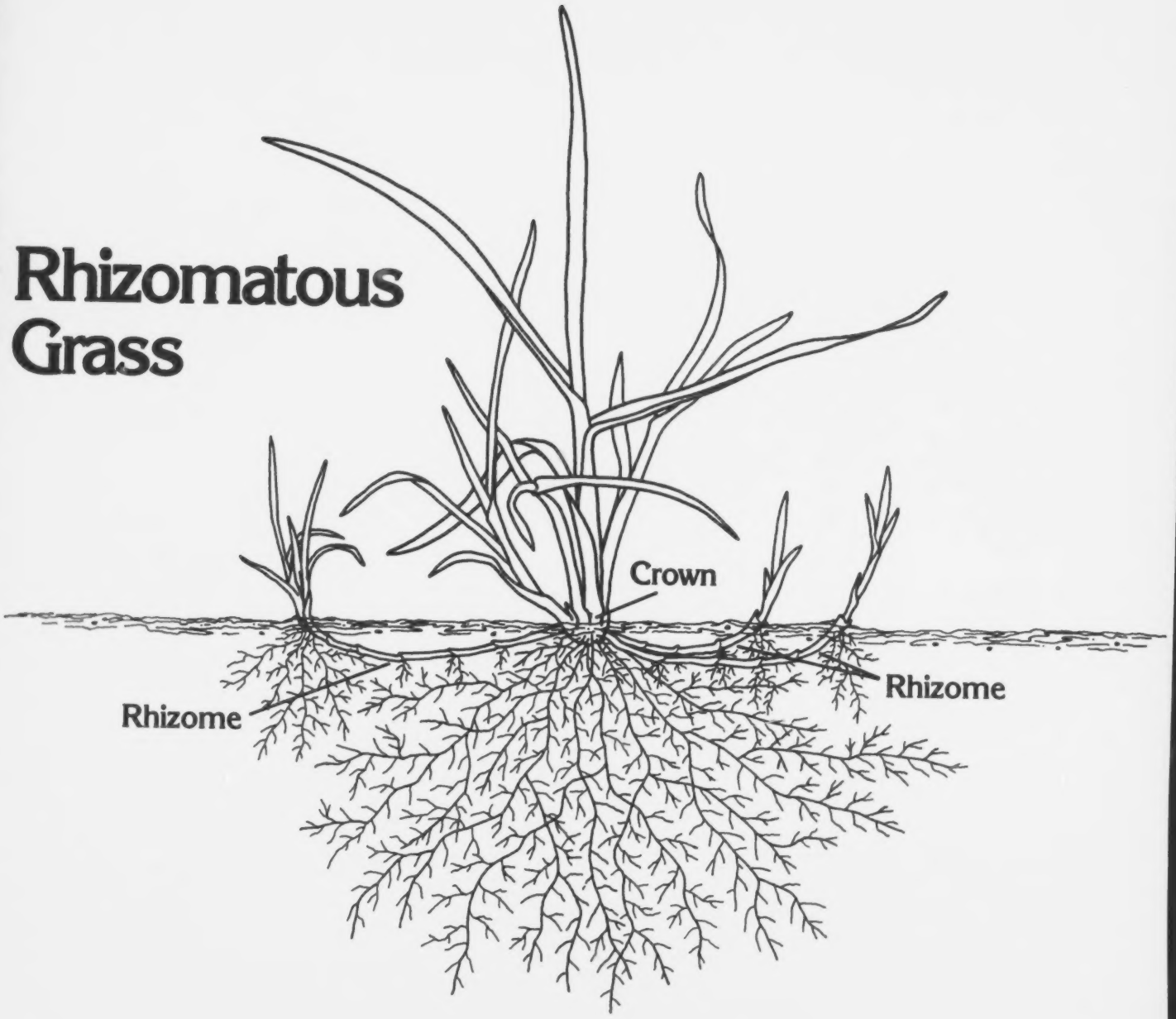
Rhizome - an underground stem, usually positioned horizontally. Distinguished from a root by the presence of nodes and internodes. Capable of producing new shoots.

Stolon - A horizontal shoot that is above-ground; roots and produces new plants (daughter plants) at each node.

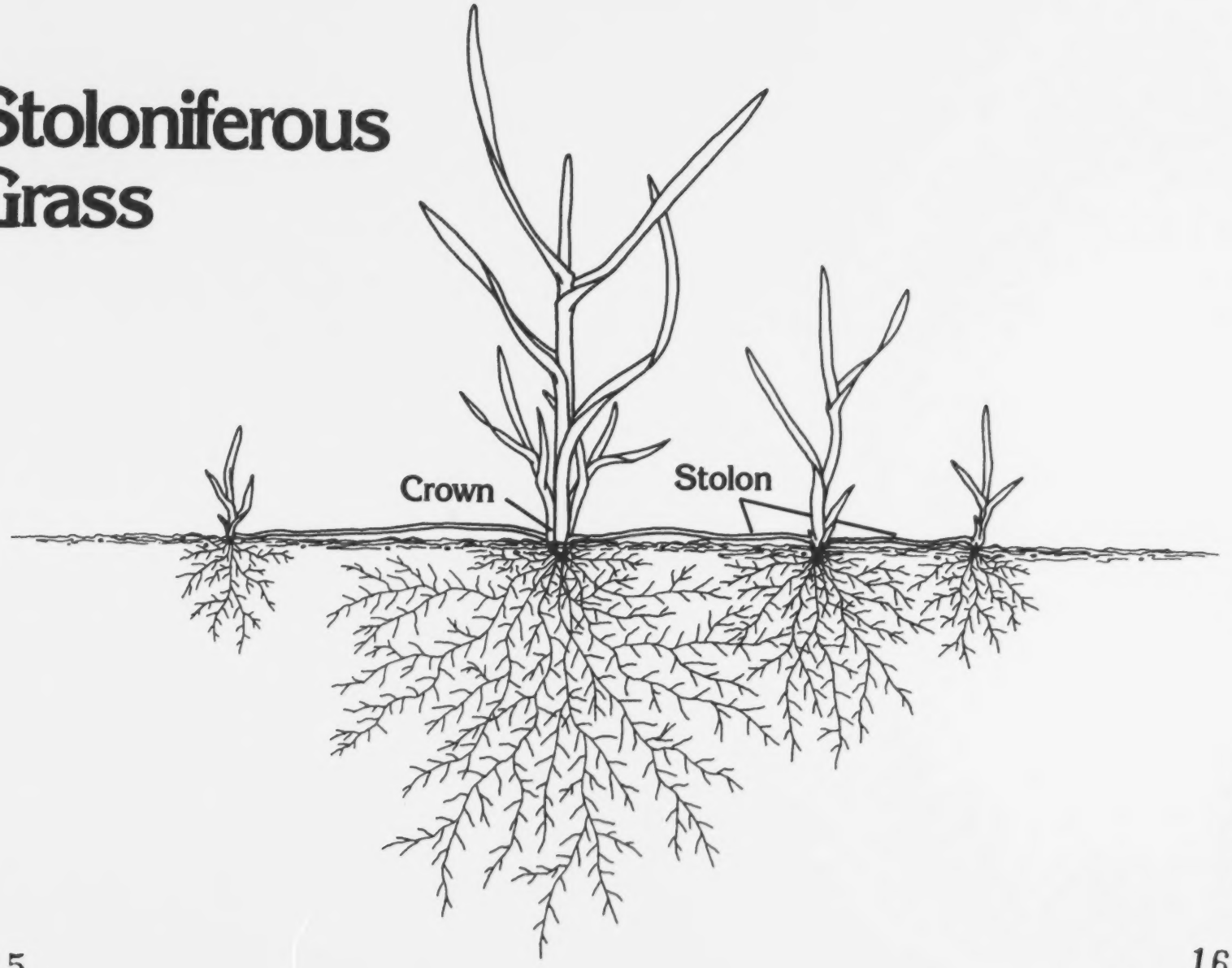
Notes:

Visual Masters

Rhizomatous Grass

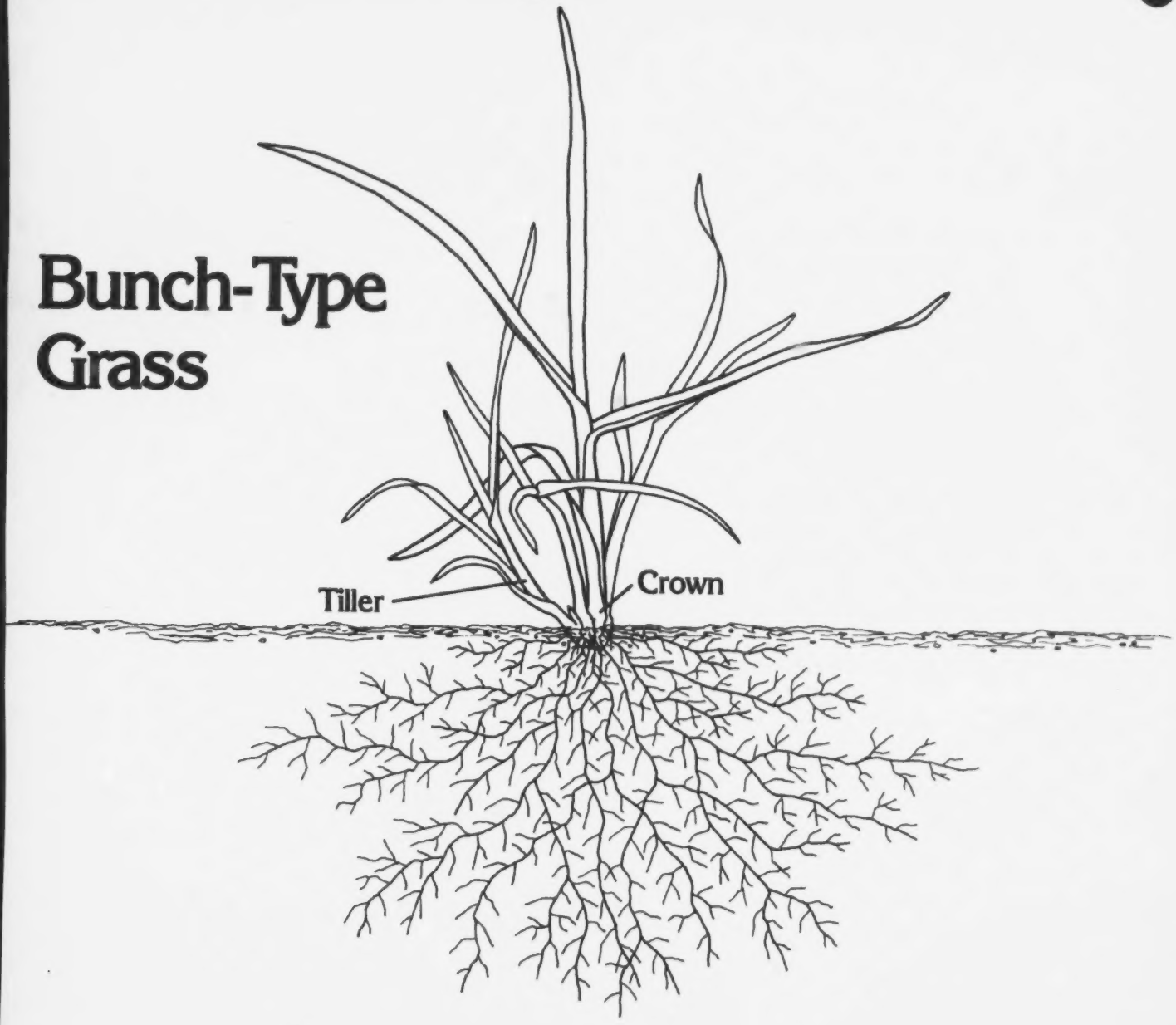


Stoloniferous Grass



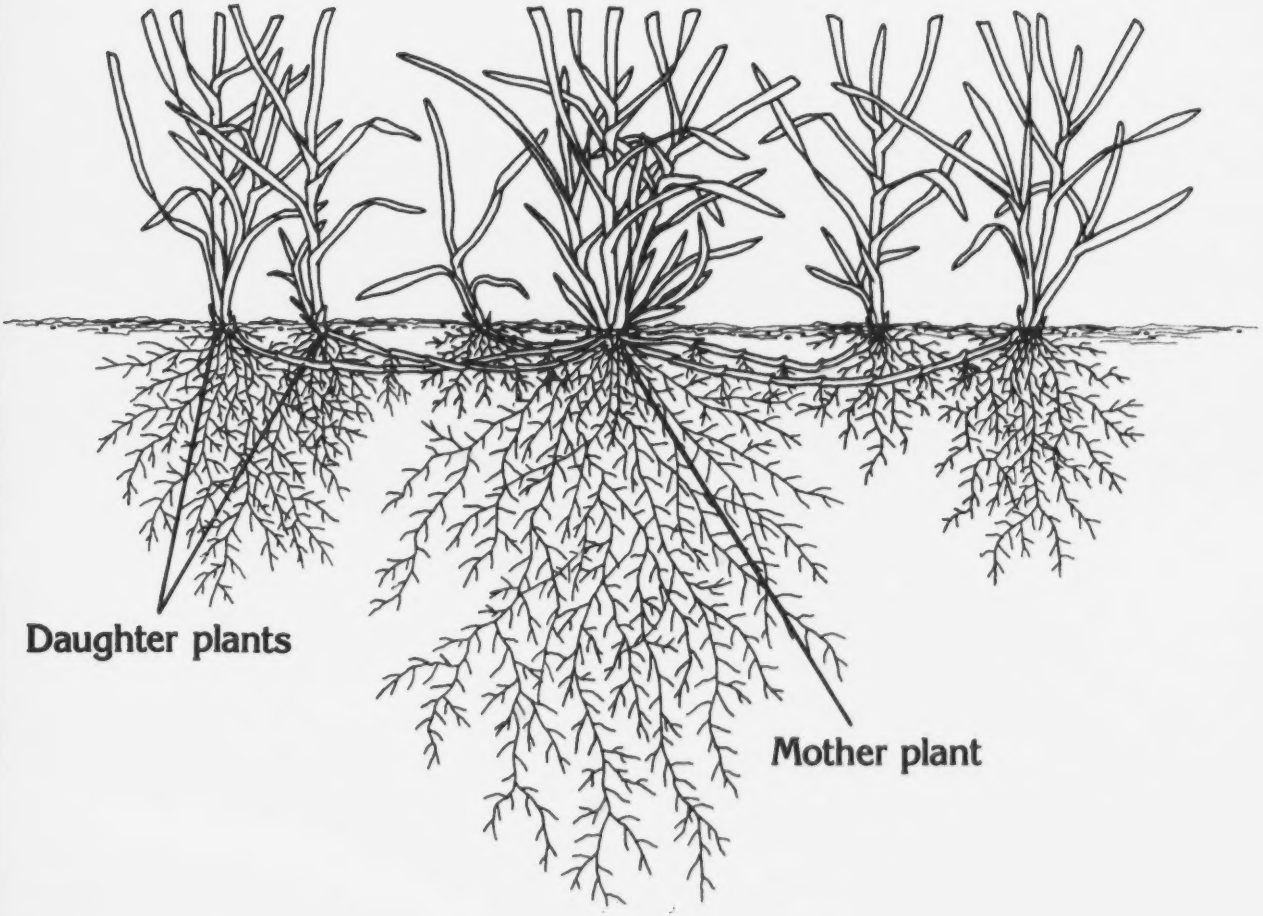
VM-SOD-2

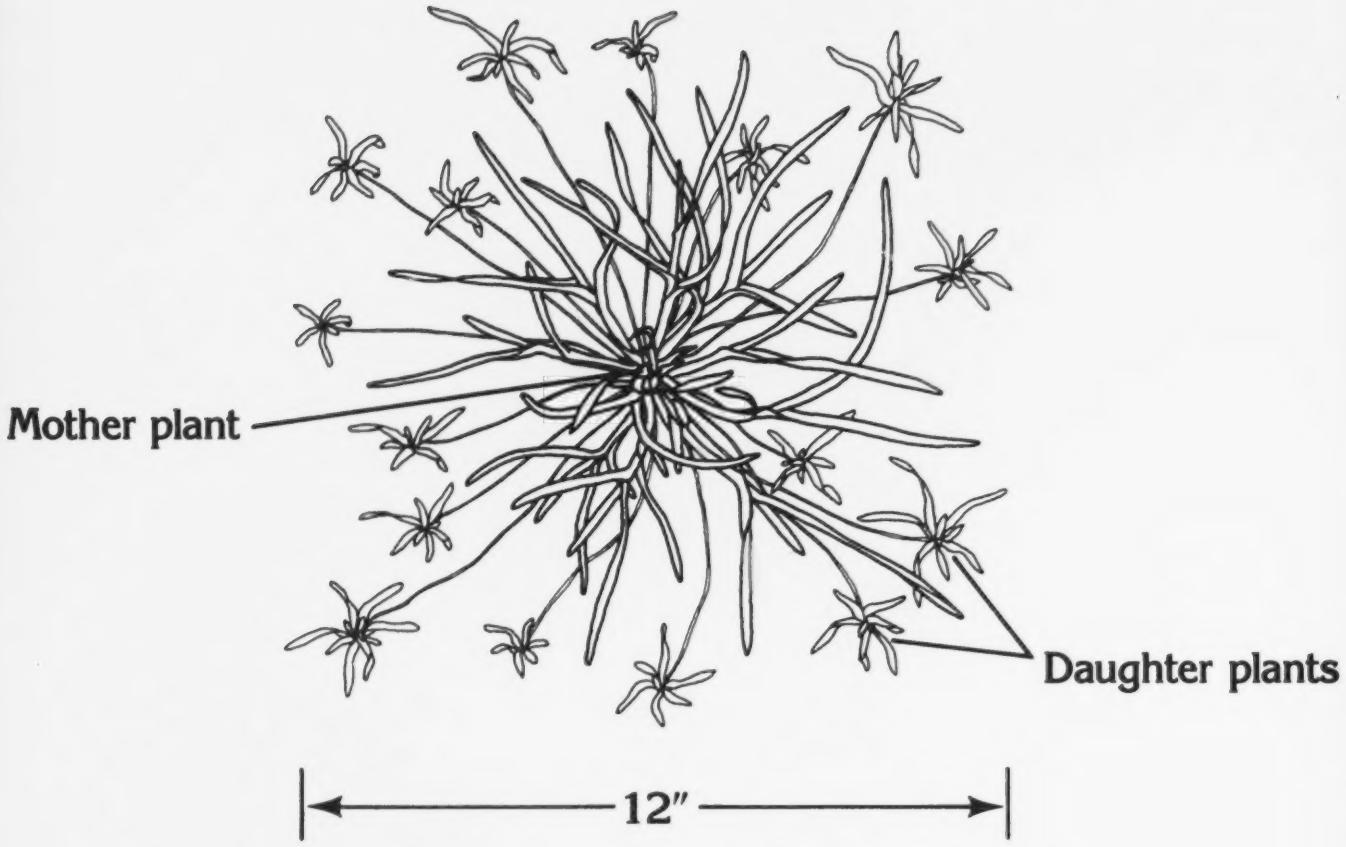
Bunch-Type Grass



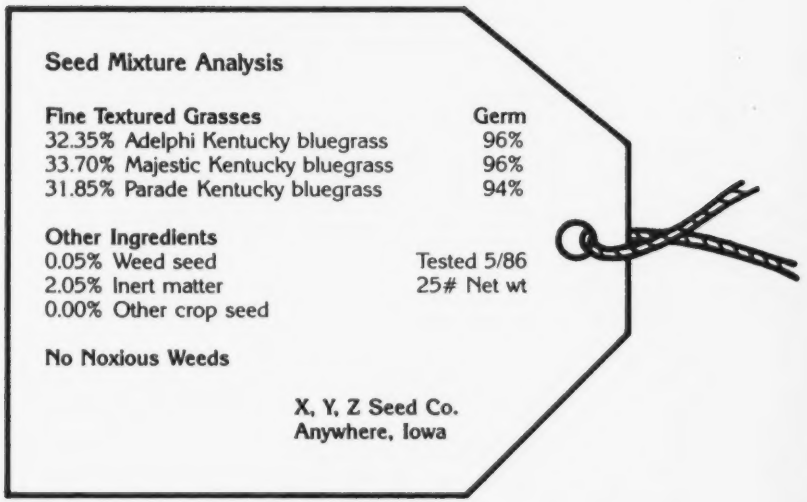
VM-SOD-3

Kentucky Bluegrass





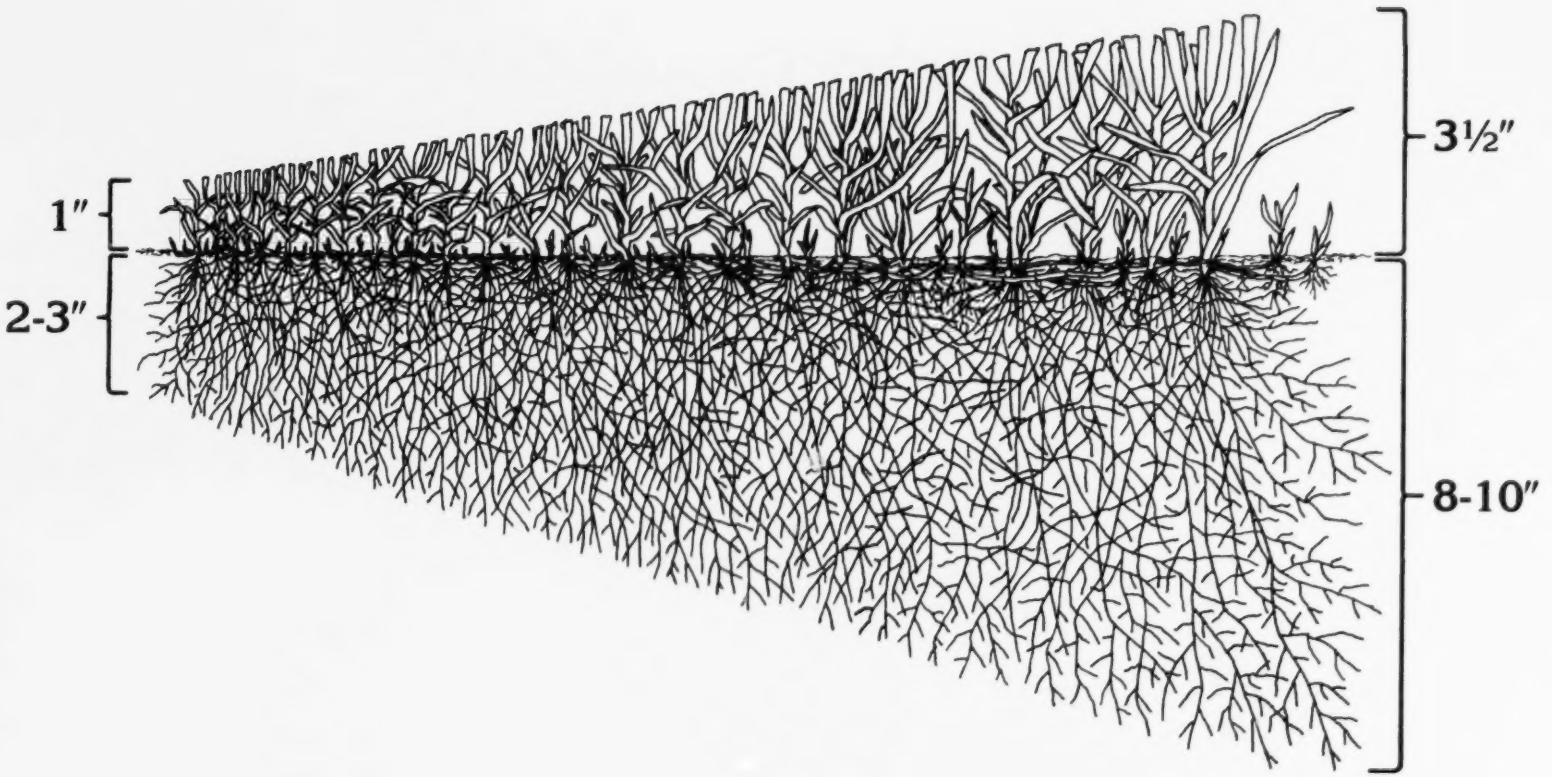
Top view of Kentucky Bluegrass with daughter plants


Seed Mixture Analysis
Fine Textured Grasses
Germ
32.35% Adelphi Kentucky bluegrass
96%
33.70% Majestic Kentucky bluegrass
96%
31.85% Parade Kentucky bluegrass
94%
Other Ingredients
0.05% Weed seed
Tested 5/86
2.05% Inert matter
25# Net wt
0.00% Other crop seed
No Noxious Weeds
X, Y, Z Seed Co.
Anywhere, Iowa

Kentucky bluegrass cultivars recommended for sod production in Iowa.

Adelphi	Glade
Aquila	Majestic
	Merit
	Midnight
Baron	Parade
Bensun (A-34)	Ram-I
	Rugby
Bonnieblue	Touchdown
Bristol	Victa
Cheri	
Eclipse	

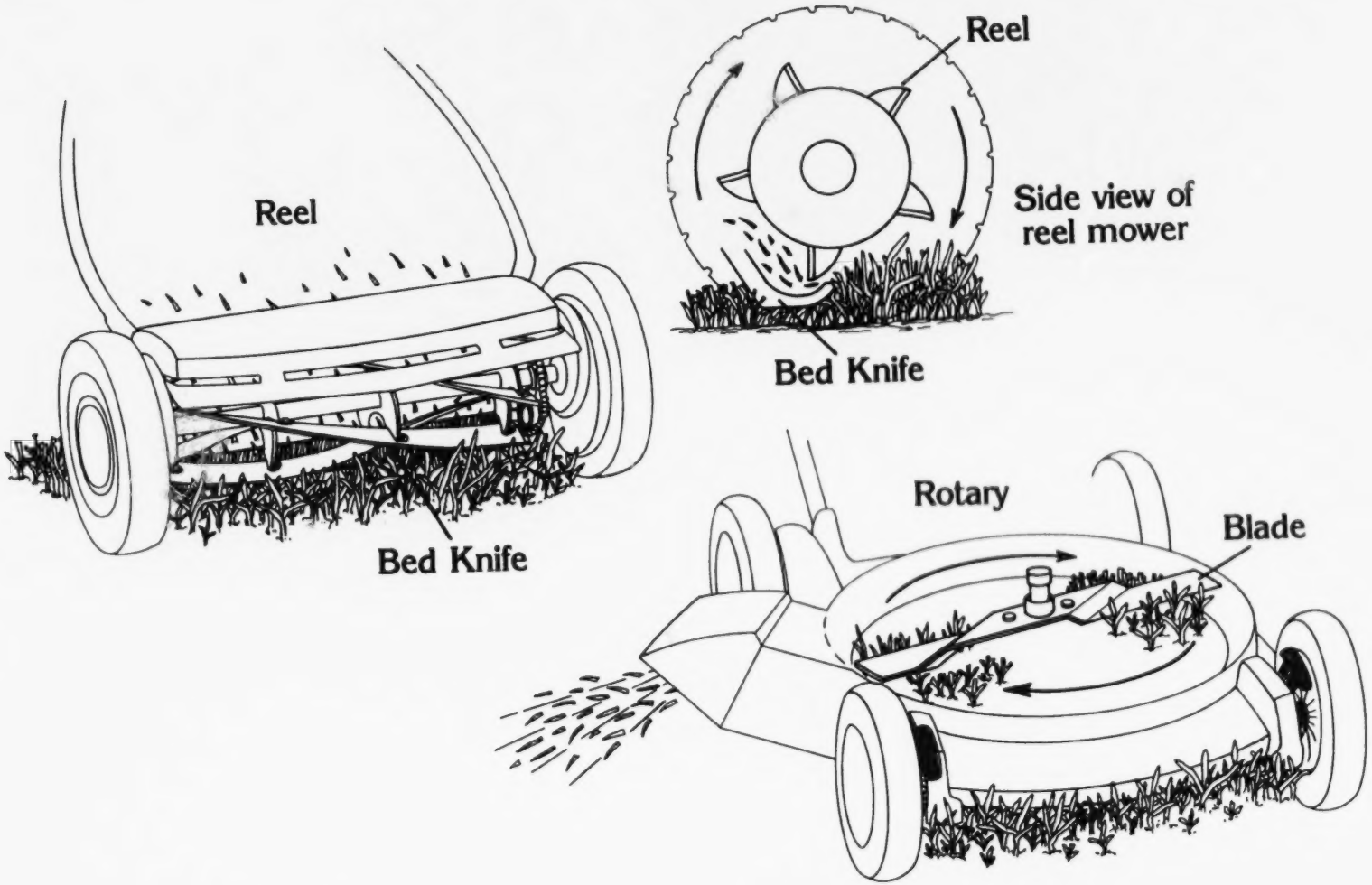
Prepared by Dr. Nick Christians, Department of Horticulture, Iowa State University, Ames, Iowa 50011.



Higher mowing heights favor root and rhizome growth.

VM-SOD-8

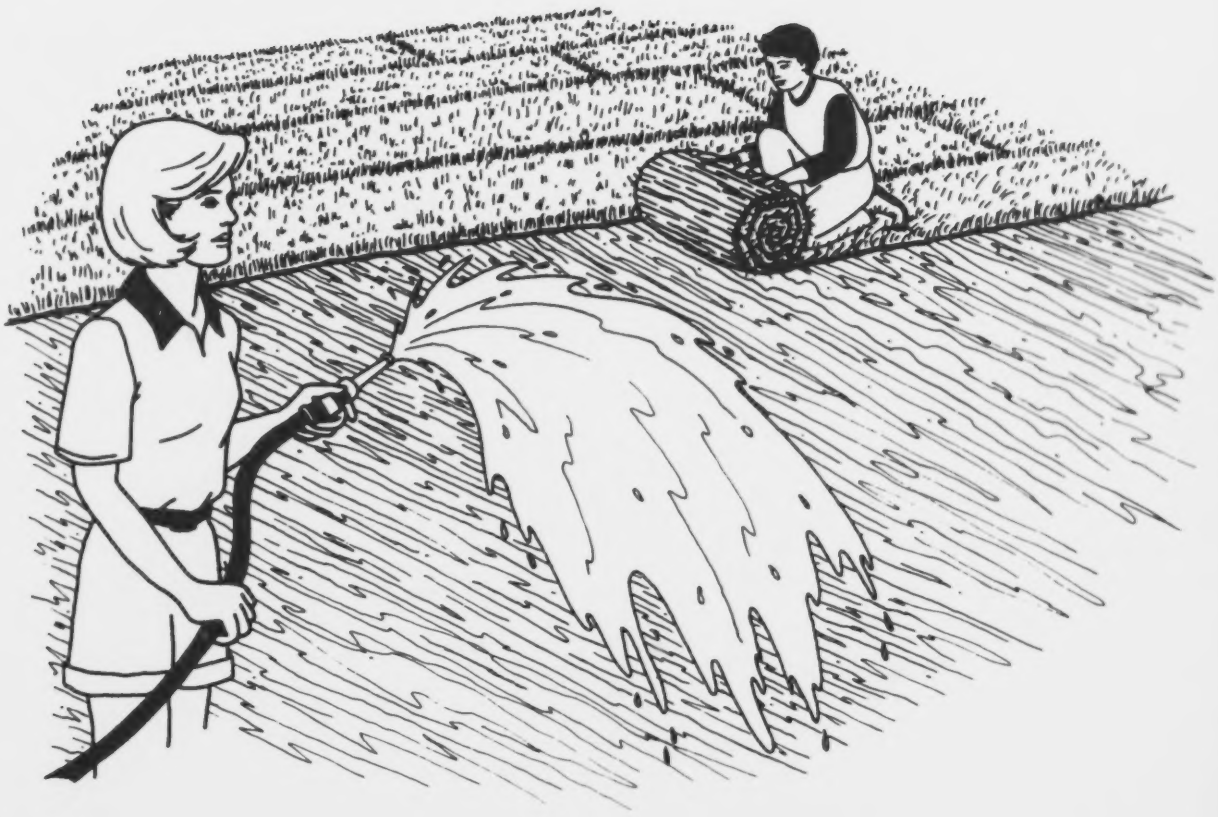
Mow to remove no more than 30-40% in a single mowing.



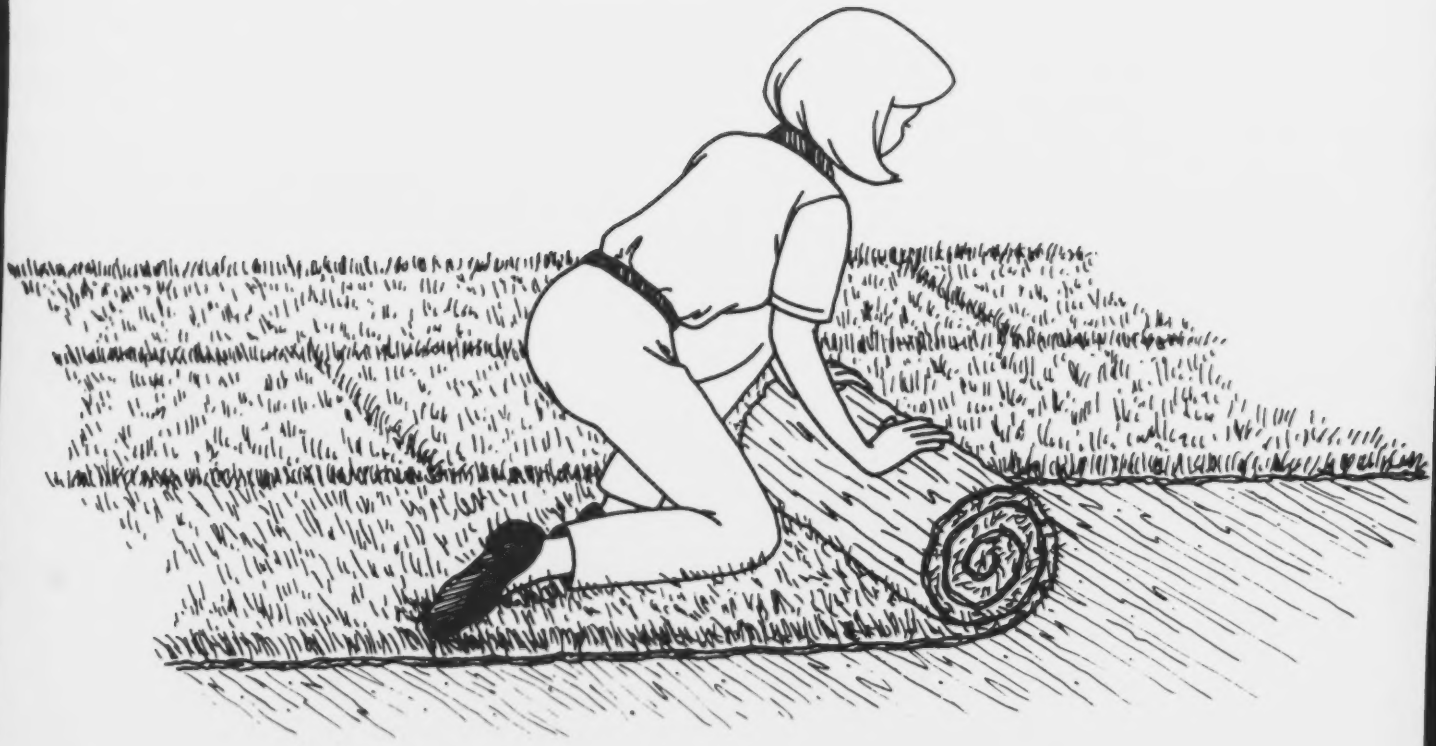
Reel versus Rotary Mowing

VM-SOD-10

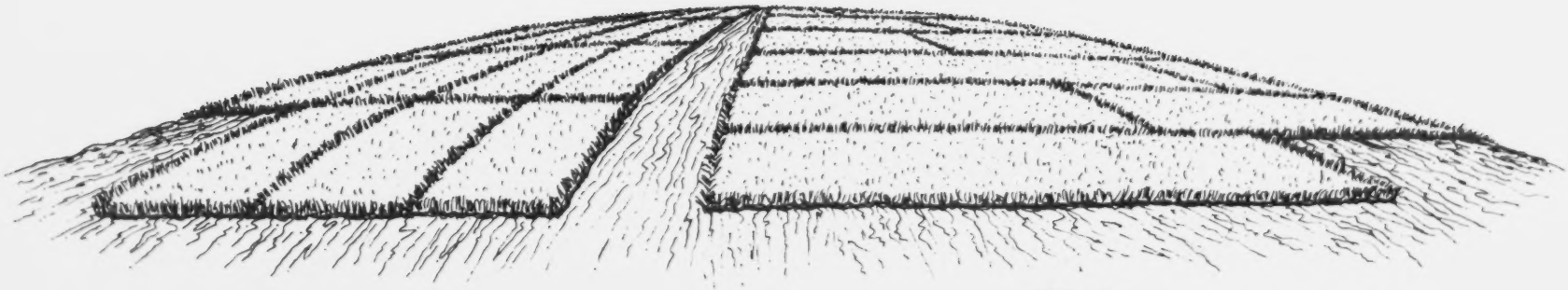
Harvesting Sod



Lightly moisten soil before sod is laid.



Installing Sod

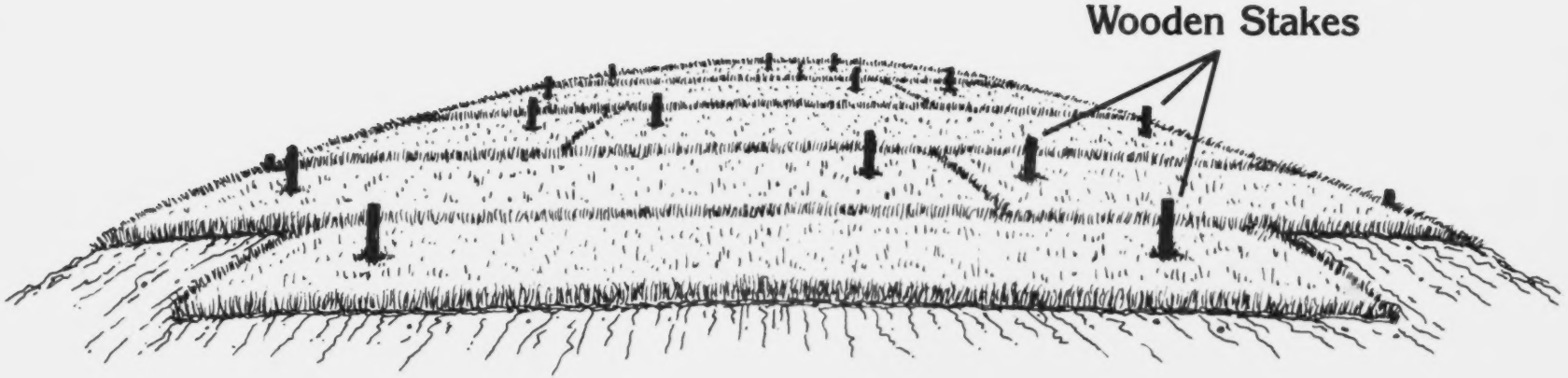


Wrong

Right

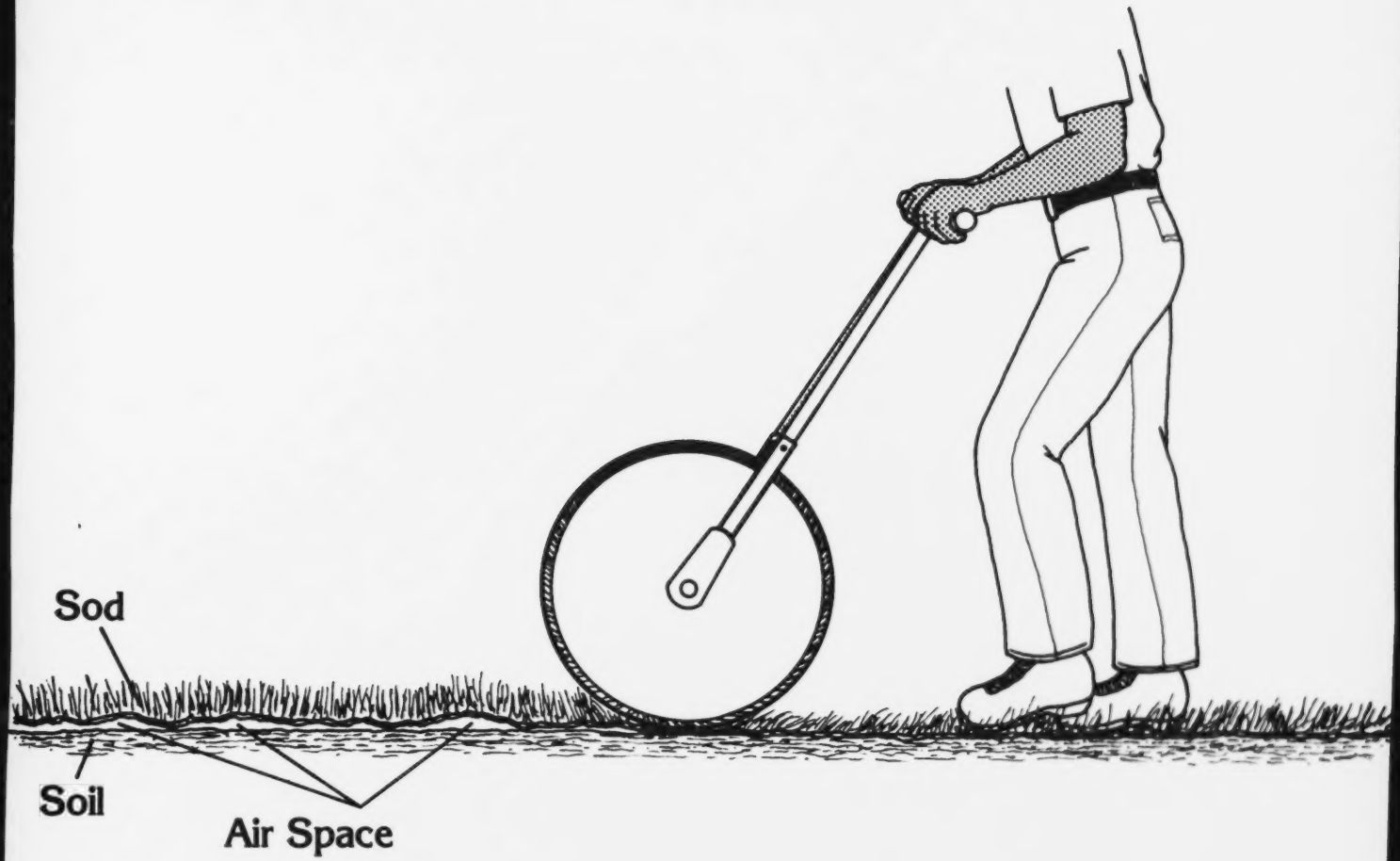
Sod rolls should be laid perpendicular to slope and staggered.

VM-SOD-14



Staking may be required on slopes of 10% or greater.

VM-SOD-15

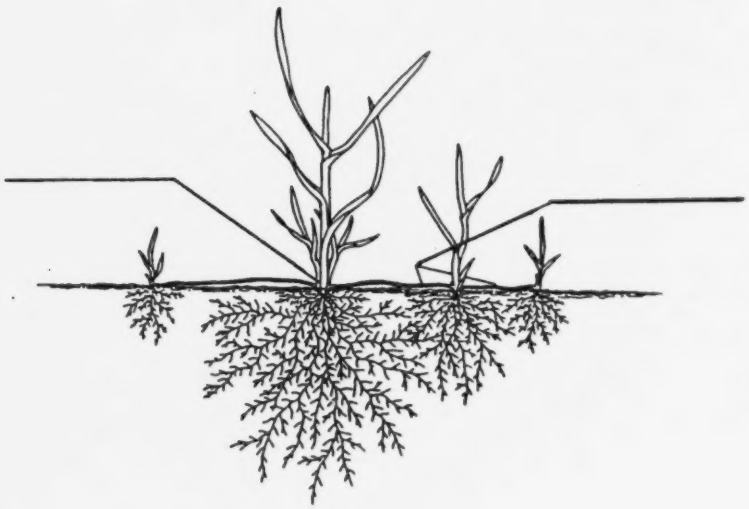


Roll to insure good contact between sod and soil.

Activities

Getting To Know Your Sod

Label the parts of the grass plant. Indicate whether the grass is bunch, rhizomatous or stoloniferous



1. _____

2. _____

3. _____

Consumer Awareness

Your neighbors have just completed building a new house and would like for you to establish a healthy lawn. You have already selected the type of grass to plant, now you are ready to purchase quality seed. To get the best quality seed at a low cost is our goal. Calculate and compare the percentage of pure live seed and the actual cost of pure live seed for the two grass seed labels below. Indicate which one would be a better buy.

% pure live seed = germ % x purity % / 100
cost of pure live seed= cost /pure live seed x 100

John Doe Seed Company
Anywhere, Iowa

Lot No. 786
Test Date: 1/25/86

$3.25/lb

Grasses	**Germ**
34.6% Adelphi Kentucky bluegrass	90%
36.2% Ram I Kentucky bluegrass	90%
27.1% Majestic Kentucky bluegrass	85%

Other Ingredients
0.0% Crop
2.1% Inert Matter
0.0% Weeds

No Noxious Weeds

John Doe Seed Company
Anywhere, Iowa

Lot No. 501
Test Date: 1/25/86

$2.00/lb

Grasses	**Germ**
38.1% Park Kentucky bluegrass	75%
24.1% Kentucky bluegrass (variety unknown)	70%
30.3% Annual Ryegrass	85%

Other Ingredients
1.1% Crop
5.5% Inert Matter 5.5% Inert matter
0.9% Weeds

Noxious Weeds: 885 Annual bluegrass

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% pure live seed = germ % x purity % / 100
cost of pure live seed= cost /pure live seed x 100

90% x 34.6%/100=31.14
90% x 36.2%/100=32.58
85% x 27.1%/100=23.04
86.76

$3.25/86.76 x 100=$3.75

John Doe Seed Company
Anywhere, Iowa

Lot No. 786
Test Date: 1/25/86

$3.25/lb

Grasses	Germ
34.6% Adelphi Kentucky bluegrass	90%
36.2% Ram I Kentucky bluegrass	90%
27.1% Majestic Kentucky bluegrass	85%

Other Ingredients
0.0% Crop
2.1% Inert Matter
0.0% Weeds

No Noxious Weeds

75% x 38.1%/100=28.6
70% x 24.1%/100=16.9
85% x 30.3%/100=25.8
71.3

$2.00/71.3 x 100=$2.80

John Doe Seed Company
Anywhere, Iowa

Lot No. 501
Test Date: 1/25/86

$2.00/lb

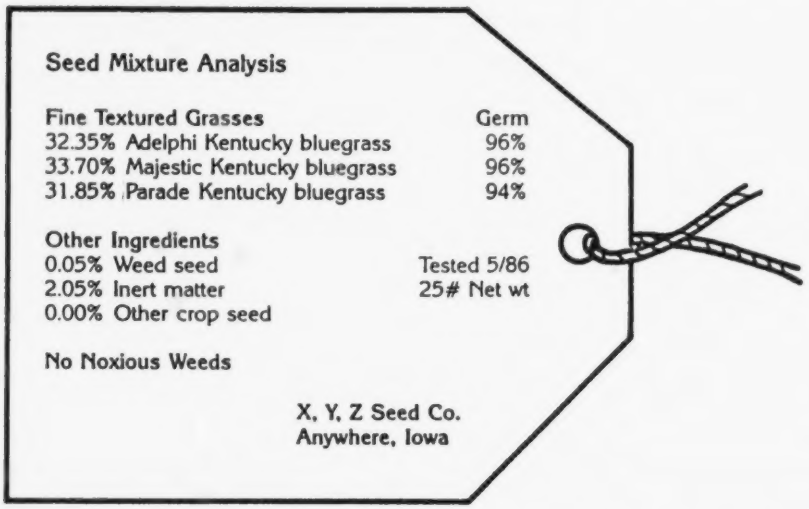
Grasses	Germ
38.1% Park Kentucky bluegrass	75%
24.1% Kentucky bluegrass (variety unknown)	70%
30.3% Annual Ryegrass	85%

Other Ingredients
1.1% Crop
5.5% Inert Matter 5.5% Inert matter
0.9% Weeds

Noxious Weeds: 885 Annual bluegrass

Content Analysis

Reading and understanding what goes into a seed mixture will help you in selecting the right seed mixture and making the best investment for your home lawn. Answer the following questions using the label provided for you.



What % of Adelphi Kentucky bluegrass is contained in the package?

What % germination does Parade Kentucky bluegrass have?

Define weed seed:

Define inert matter:

Define other crop seeds:

Define noxious weeds:

What is the date it was tested?

Planting Depth Experiment

It is important to plant grass seeds at the proper soil depth. You will conduct a research experiement to determine the effects of planting depth on ryegrass.

Planting Depth	# of days until emergence Expected
1/2"	
1"	
1 1/2"	
2"	
3"	
4"	

STEPS:

1. Obtain an clean glass rectangular cotainer, such as a fish aquarium, that is at least five inches deep.
2. Place moist sterile soil in container on a slope.

3. Plant Rye grass at the following depths : 1/2", 1", 1 1/2", 2", 3", and 4".
4. Mark the outside of the container at the appropriate depths.

5. Cover seeds with moist soil so that the container is level.
6. Place in sunlight.
7. Record data daily.

SUMMARY

\# of Days until emergence

Plant Depth	Actual
1/2"	
1"	
1 1/2"	
2"	
3"	
4"	

1. Planting depth range for best emergence:

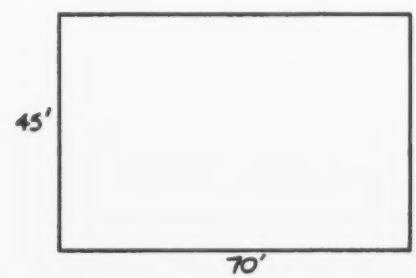
2. Average number of days until emergence:

Keep your grass green

Once grass has emerged, nitrogen becomes the most important fertilizer element. You have two sod producing fields upon which you want to apply 27 lbs. of N/Acre. Calculate the pounds of nitrogen you need for each field.

Calculations 43,560 sq. ft. / acre

Step 1 : Sq. ft. = length x width
Step 2 : % of an acre = sq. ft. / 43,560
Step 3 : % of an acre x 27 = pounds of nitrogen needed.



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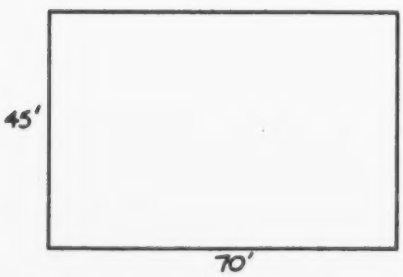
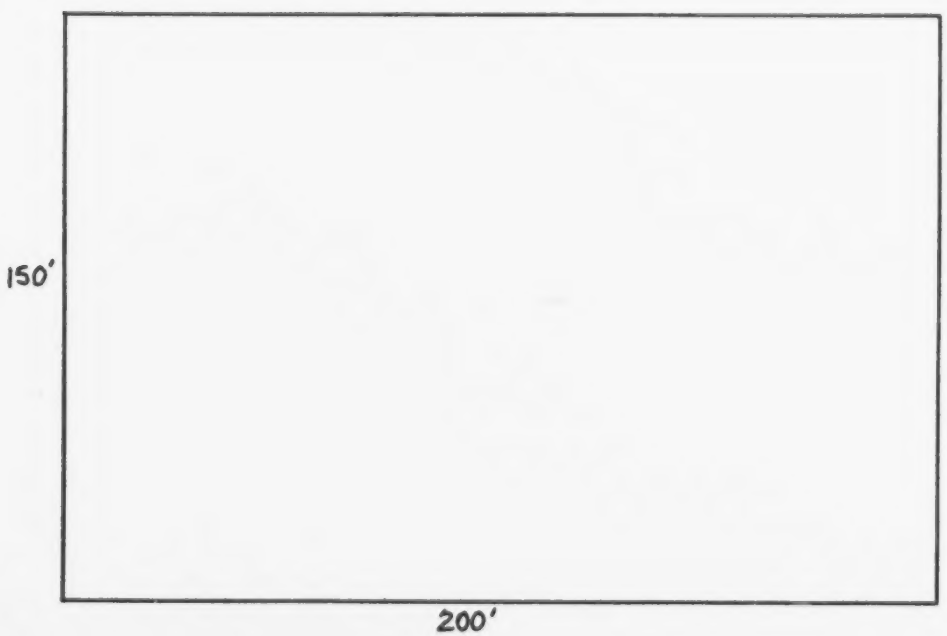


45 x 70 = 3150
3150/43560 = 7.2%
7.2% x 27 = 1.94



150 x 200 = 30000
30000 /43560 =68.9%
68.9% x 27 = 18.6

Marketing Sod

Write an essay discussing the proper cutting depth, transportation, the length of time the sod can be held in stacks and the potential market in our area.

Marketing Sod

Write an essay discussing the proper cutting depth, transportation, the length of time the sod can be held in stacks and the potential market in our area.

- proper cutting depth of Kentucky bluegrass sod is from 0.5-0.75 inches
- sod can be stacked for transport in rolls or in strips
- length of time sod can be held in stacks depends on the temperature
- primary market is the housing industry

Sod Installation

Installing sod is a three phase process. If you were asked to install sod on your school football field, what three steps would you go through. Write a summary that lists the steps with a description of the process done in each.

Sod Installation

Installing sod is a three phase process. If you were asked to install sod on your school football field, what three steps would you go through. Write a summary that lists the steps with a description of the process done in each.

1. Site Preparation:
   Prepare soil
   Soil test

2. Installation of the sod:
   Lightly moisten soil
   Sod rolls should be laid perpendicular to slope and staggered
   Staking may be required on slopes of 10% or greater
   Roll to insure good contact between sod and soil

3. Post installation care:
   Water daily for first 7 days
   Mow sod when grass begins to grow
   Follow fertilzation program

Sod Placement

Draw the pattern of newly installed sod on a lawn that has a slope of less then 10%.

Draw the pattern and placement of stakes for newly installed sod on a lawn that has a slope of greater then 10%.

Sod Placement

Draw the pattern of newly installed sod on a lawn that has a slope of less then 10%.

Consult VM-SOD-14

Draw the pattern and placement of stakes for newly installed sod on a lawn that has a slope of greater then 10%.

Consult VM-SOD-15

Slide Description

Sod Production

1. Sod field 6 weeks after seeding.
2. Mature sod field.
3. Properly fertilized, high quality Kentucky bluegrass sod.
4. Sod field showing area that has been harvested.
5. Cut the sod at a depth of from 0.5 to 0.75 inches.
6. Tractor - mounted sod harvesting machine.
7. Fork lift for loading sod pellets mounted on the back of a truck.
8. Laying sod.
9. Sod staked on a hillside.
10. Sod allowed to dry after it was laid.

Slides provided by Faculty of Department of Horticulture,
Iowa State University, Ames, Iowa.

horticulture guide

Turfgrass care for athletic fields

Athletic fields are among the most difficult turfgrass areas to manage. In spite of very heavy wear, they must be kept smooth and uniform for play and be maintained in an aesthetically pleasing condition.

This guide answers some of the questions commonly asked by groundskeepers in Iowa. It includes information on grass species and cultivars that are recommended for athletic fields in the state, as well as information on establishment, fertilization, and general management practices.

Seed or sod?

Either sod or seed can be used in establishment of athletic fields. If the area is to be sodded, the soil on that the sod is grown should be compatible with the soil in the field. If the sod was grown on a high organic "muck" soil and the field is a clay loam, it is unlikely that the sod will root well. During the season, the sod may tear away easily and ruin the field. Such field conditions can also result in player injuries. On intensely managed athletic fields, such as stadiums for professional football, sod is often grown off site on soil which exactly matches the soil on the field. The average school district cannot afford this, but it is very important that the sod used be grown on soil similar in texture to the soil on the field.

If the budget permits, sodding can be a very effective means of establishing an athletic field, but generally school districts will find it necessary to establish their fields by seed.

Which grass is best?

The species to seed on an athletic field depends on the availability of irrigation and the location. The two best choices for seeding Iowa athletic fields are tall fescue or a mixture of Kentucky bluegrass and perennial ryegrass. If no irrigation is available, tall fescue is the best choice. However, tall fescue is intolerant of cold winters; if the field is located north of Interstate 80, tall fescue may not be the best selection. The best combination of seed for both irrigated and nonirrigated fields in the northern part of the state is the bluegrass-ryegrass mixture.

Where tall fescue is used, Falcon, Kentucky 31, or Rebel are recommended. It should be seeded at 8 to 10 pounds per 1,000 square feet. If the bluegrass-ryegrass combination is used, combine it in a mixture of **50 to 60** percent Kentucky bluegrass and **50 to 40** percent perrennial ryegrass. This mixture should be seeded at 2 to 3 pounds per 1,000 square feet. A mixture of two or three of the following bluegrasses and one or two of the following ryes is currently recommended:

Kentucky bluegrass	**Perennial ryegrass**
Adelphi	Citation
Baron	Derby
BenSun (A-34)	Diplomat
Bonnieblue	Manhattan
Cheri	NK-200
Glade	Pennfine
Majestic	Regal
Midnight	Yorktown
Parade	
Ram I	
Rugby	
Touchdown	
Victa	

Other cultivars can be used, but the ones listed have performed quite well in the Midwest. NK-200 is one of the more cold-tolerant ryes and is recommended for northern Iowa. The ryegrass cultivars that have performed best at the Horticulture Research Station under a variety of management regimes are Pennfine and Manhattan.

Prepared by Nick Christians, assistant professor of horticulture.

Cooperative Extension Service
Iowa State University
Ames, Iowa 50011

50

Pm-1040 | Revised | June 1984

When and how should the field be established?

The best time to establish an athletic field in central Iowa is between August 15 and September 30. In northern Iowa, fields should be established by September 15. In southern Iowa, seeding in early October will usually establish a satisfactory cover. Establishment in spring and summer is possible if irrigation is available. However, seedings in spring and summer may become infested with annual weeds, and failures of spring and summer seedings are common. If spring seeding is planned, contact the local county extension office for specific recommendations on seeding rates and herbicide recommendations.

A soil test should always precede the establishment of an athletic field. "Build-up" applications of phosphorus or potassium and any required lime should be applied and worked in during the tilling operation.

Fertilization is very important at seeding. Starter fertilizers are available commercially for lawns. Instructions for their use are printed on the bag. If an agricultural grade fertilizer is used, choose one high in phosphorus, such as 18-46-0 or 13-25-12. Proper fertilization at the time of establishment should include approximately 1 to 1.5 pounds of P_2O_5 and 0.5 to 0.75 pound of nitrogen per 1,000 square feet. The starter fertilizer should be applied on the surface with the seed. Additional fertilizer at the rate of ½ pound of nitrogen per 1,000 square feet should be applied to the area after 3 to 4 weeks, when the grasses are 1 to 1½ inches tall. See Pm-1072, *Establishing a Lawn from Seed,* for more information on seeding.

Watering is usually necessary at the time of establishment. Grass seedlings are very susceptible to desiccation, and the surface of a newly seeded grass area should not be allowed to dry. If an area that cannot be watered is to be established, the site should be mulched with straw. Evenly spreading 1 to 1½ bales of straw per 1,000 square feet should be sufficient.

How should the established field be fertilized?

Insufficient maintenance fertilization is one of the most common problems with athletic fields in Iowa. Athletic fields must be fertilized on a regular basis with the proper amounts of nutrients if they are to be maintained in a playable condition. Nitrogen (N) is the most important of the fertilizer elements for turfgrass areas, but potassium (K) can also play an important role, particularly on areas that receive a lot of traffic. A fertilizer that has a high analysis of N and a moderately high analysis of K should be chosen; 10-5-5, 20-5-10, 30-5-15, or some similar analysis will be fine. Iowa State University currently recommends that this maintenance fertilizer be applied at the following rates and times for the bluegrass-ryegrass fields:

½ pound N/1,000 square feet in April
½ pound N/1,000 square feet in May
½ pound N/1,000 square feet in June
1 pound N/1,000 square feet in late August
1 pound N/1,000 square feet in late September

The three applications in spring of ½ pound N each can be combined into two ¾ pound N applications, one in April and one in May; but do not exceed 1½ pounds total N per 1,000 square feet in spring.

Fertilization of tall fescue fields should be based on the following program:

¾ pound N/1,000 square feet in late April or early May
1 pound N/1,000 square feet in late August
1 pound N/1,000 square feet in late September
See Pm-1057, *Maintenance Fertilization of Turfgrasses,* for more information.

What about aerification?

Compaction is also a major problem that often affects athletic fields. Aerification, the process of loosening the soil mechanically without seriously disrupting the uniformity of the turf, will likely become necessary during the playing season, and every school district should own, or have access to, an aerification unit. Aerification in two directions every 2 or 3 weeks during the growing season is adequate. Spring aerification invites weed problems and should be followed with a preemergence herbicide application. Once preemergence herbicides have been applied, no further aerification should take place until after annual weeds have completed germination. Aerification during temperature stress periods in mid-summer may directly damage the field and should be avoided unless the field can be irrigated. See Pm-1127, *Thatch Control in the Home Lawn,* for more information.

Overseeding, the process of applying seed directly over a mature stand of turf, often becomes necessary on athletic fields. This is especially true on tall fescue fields. Tall fescue is a bunch-type grass and any damaged areas will require annual overseeding.

If aerification is to be combined with overseeding, six to eight passes in different directions are recommended. The seed should then be applied and a drag mat, or a section of chain link fence, should be used to drag the seed into the aerification holes. If overseeding and aerification are to take place in the spring, contact the local extension office for herbicide recommendations.

How should the field be mowed?

The condition of the roots and rhizomes is closely related to the mowing height. The lower the mowing height, the weaker the root system will be and vice versa. The field should be maintained at a high mowing height during spring and summer if it is not being used for play; 2½ to 3 inches for Kentucky bluegrass-perennial ryegrass mixtures, 3 to 3½ inches for tall fescue. During the playing season, the bluegrass-ryegrass field can be maintained at 1½ to 2 inches. Tall fescue fields should not be mowed lower than 2½ inches.

What about weed, insect, and disease control?

Annual grasses, such as crabgrass and goosegrass, should be controlled in the spring with applications of preemergence herbicides. Broadleaf weeds, such as dandelions and plantain, are best controlled in the fall with postemergence herbicides. If the field is to be used for football, try to apply the chemicals on a Monday of a week when no game is scheduled. This will allow maximum time until the next scheduled game. For a more detailed discussion of lawn weed control, see ISU extension publication Pm-930, *Lawn Weed Control.*

Insects may become a problem, particluarly in western Iowa. Preventive applications of insecticides are not recommended unless there has been a history of insect damage on the field. The types of insects that damage athletic fields and recommended control measures for these insects vary with location. Contact the local county extension office if insect damage is suspected.

Turfgrass diseases are unlikely to cause serious damage to athletic fields, and no preventive fungicide programs are presently being recommended. Again, if disease problems are suspected, contact the county extension office.

Other things to consider?

Traffic control is very important. All excess traffic on the playing surface should be avoided. This includes band practice. Coaches should be encouraged to rotate practices on different sections of the field. Wet fields will readily compact and all unnecessary traffic should be kept from the area after a rain.

There are many other aspects of athletic field management that are not covered in this guide. Many of these are a matter of common sense, and many can be learned only through experience. However, with these recommendations, and a little extra care, athletic fields in Iowa can be maintained in excellent playing condition.

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ISUP-68

TG-6-82
horticulture guide

Maintenance fertilization of turfgrasses

Why fertilize?

There are 13 mineral nutrients known to be essential to turfgrasses. The quantity of most of these nutrients contained in the soil is high compared with the requirements of turfgrass plants. However, the demands for nitrogen, phosphorus, and potassium often exceed the supply in the soil. Thus, it becomes necessary to add these elements through fertilization.

Turfgrasses require nitrogen in the largest amount of any of the essential nutrients. For this reason, nitrogen is applied in largest amounts with fertilization. Nitrogen nutrition is important to turfgrasses because it can affect shoot growth and density, root growth, and susceptibility to damage from disease, heat, cold, and drought.

Turfgrasses require potassium in relatively large amounts, second only to nitrogen. Potassium influences turfgrass rooting, disease susceptibility and drought, heat, and cold hardiness.

Phosphorus is required by turfgrass plants in smaller amounts than nitrogen and potassium. Phosphorus is important in the establishment, rooting, maturation, and reproduction of turfgrasses.

The best means of determining the fertilizer requirements for an area is to have the soil tested. Soil tests provide valuable information on the phosphorus and potassium requirements of a soil at a nominal cost. Many soils in Iowa have a high pH. Turfgrass grown on these alkaline soils may show iron chlorosis, or yellowing. A soil test will indicate if an area requires iron. Contact your county extension director for soil testing information.

What's in a fertilizer bag?

Fertilizer companies are required by law to list on a fertilizer bag the amounts of elements contained in the fertilizer. This is referred to as a **guaranteed analysis.** Also listed on the bag is the fertilizer grade. A fertilizer grade designates the percentage of nitrogen, available phosphate, and water soluble potash in the product. A 10-6-4 grade fertilizer contains 10 percent nitrogen, 6 percent available phosphate, and 4 percent water soluble potash. Thus, a 40 pound bag of 10-6-4 contains 4 pounds of nitrogen (10 percent of 40), 2.4 pounds of available phosphate (6 percent of 40), and 1.6 pounds of water soluble potash (4 percent of 40).

Fertilizer recommendations are often made using fertilizer ratios. A fertilizer ratio refers to the relationship between the percentages of nitrogen, phosphate, and potash. A 16-8-8 grade fertilizer contains twice as

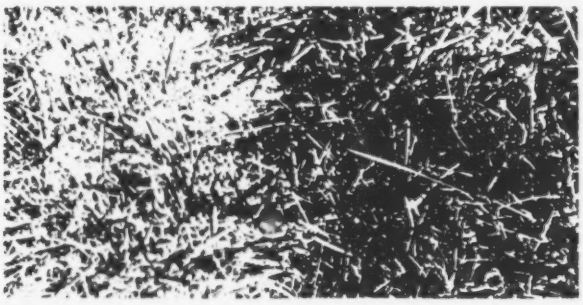

Fig. 1. Dollar for dollar, fertilizer does more to improve lawns than any other management factor. Note above the unfertilized area (left) with the area that was fertilized.

Fig. 2. Overlapping the wheels of the drop spreader will prevent the fertilizer skips which caused the uneven grass growth illustrated above.

Prepared by Norm Hummel, former extension turfgrass specialist; reviewed by Michael L. Agnew, extension turfgrass specialist.

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much nitrogen as phosphate or potash. Thus, it would have a 2-1-1 ratio. Grades of 10-5-5 and 20-10-10 also have 2-1-1 ratios. A grade of 20-5-10 would have a 4-1-2 ratio. The easiest way to determine ratio is to divide each number in the grade by the smallest number in the grade, or by the highest whole number divisible into all three numbers of the grade.

A turf grade fertilizer is normally defined as a complete fertilizer (contains nitrogen, phosphate, and potash) having an approximate 2-1-1 or 3-1-2 ratio, and having at least 35 percent of the total nitrogen as water insoluble nitrogen (WIN). Water insoluble nitrogen is not immediately available to the plant. Instead, the nitrogen is released slowly over relatively long periods of time. Fertilizers with at least 35 percent WIN can be applied at higher rates than farm grade fertilizers (water soluble nitrogen) with little risk of burning the turf. A fertilizer bag may have the following label:

20-5-10
Guaranteed Analysis

Total Nitrogen	20%
8% Water Insoluble Nitrogen	
Available Phosphate	5%
Water Soluble Potash	10%

On the label, the 20 percent represents the total percentage of nitrogen in the bag. The 8 percent represents the total percentage of nitrogen in the bag that is water insoluble. The percentage of the total nitrogen that is water insoluble may now be determined. Divide the percent water insoluble nitrogen by the percent total nitrogen, and multiply by 100. In this case 8% ÷ 20% × 100, or 40 percent of the total nitrogen is water insoluble. The fertilizer contains more than 35 percent WIN so it is considered a turf grade fertilizer.

What types of fertilizer are available?

The ideal fertilizer program provides uniform growth throughout the growing season. The development of a sound fertility program based on the source of nitrogen is important in moving toward this ideal. Nitrogen sources are divided into two broad groups—quickly available (water soluble) and slow-release.

Quickly available nitrogen sources include urea, ammonium nitrate, ammonium sulfate, diammonium phosphate, and others. These materials are water soluble, and the nitrogen is immediately available for plant uptake. Fertilization with soluble nitrogen sources results in a flush of growth and rapid depletion of available nitrogen. Thus, it is necessary to make several light applications of these materials to obtain uniform growth over a long period of time. Soluble nitrogen sources are less expensive per pound of nitrogen than the slow-release fertilizers.

Slow-release fertilizers include natural organics, synthetic organics, or coated nitrogen materials. The release of nitrogen from these materials may be due to microbial decomposition alone, or in combination with chemical and physical processes. Since the activity of microorganisms is dependent on soil temperature and moisture, nitrogen availability from slow-release fertilizers will vary with the time of the year and weather.

Natural organic fertilizers include activated sewage sludges, manures, animal tankage, and others. These materials are more expensive per unit of nitrogen than other nitrogen sources, and they have a low nitrogen analysis. Since the release of nitrogen is due to microbial decomposition, nitrogen availability is low in cool or dry months.

Ureaform is a generic name for fertilizers containing several compounds that are the product of reacting urea with formaldehyde. These compounds have different solubilities, and their resistance to microbial decomposition varies. Therefore, a small amount of nitrogen is being released over a relatively long period of time.

IBDU (isobutylidene diurea) is a synthetic nitrogen source that is dependent on hydrolysis to release nitrogen. Since the release of nitrogen from IBDU is not totally dependent on microbial activity, IBDU has an advantage of releasing nitrogen during periods of cool weather, provided that moisture is adequate.

Sulfur-coated urea is an example of a slow-release fertilizer made by coating a soluble nitrogen material with an impermeable coat—sulfur. The rate of nitrogen release from sulfur-coated urea changes as coating thickness varies. Sulfur-coated urea will release nitrogen uniformly during periods of cool or warm weather.

Many fertilizers contain both slow-release and soluble nitrogen in the same formulation. Such fertilizers would have the advantage of containing quickly available nitrogen, as well as the long-term benefits of slow-release nitrogen.

How much fertilizer should be applied?

Again it must be emphasized that a soil test to determine fertilizer requirements is the best guide for proper fertilization. When a soil test is not used, apply a fertilizer with an approximate 4-1-2 ratio or a straight nitrogen carrier at a rate of 3 to 4 pounds of nitrogen per 1,000 square feet per season. Lower rates are recommended for spring to avoid over-stimulation of the grass. Over-stimulation of grass may result in increased ocurrence of *Helminthosporium* leafspot damage. It will also deplete stored food reserves, making the grass more susceptible to heat and drought stress.

When a farm grade (soluble nitrogen) fertilizer is used, apply at a rate of ½ pound of nitrogen in mid-spring and again in early summer. See table 1 to determine how much fertilizer to apply to obtain this rate of nitrogen. In late summer and in mid-fall, fertilize at a rate of 1 pound of nitrogen per 1,000 square feet each time.

If a fertilizer contains at least 35 percent of the nitrogen as water insoluble nitrogen, apply in late spring at a rate of 1 pound of nitrogen per 1,000 square feet. In early fall, apply again at a rate of 2 pounds of nitrogen per 1,000 square feet.

Precautions

Most fertilizers are salts, and they will burn grass if improperly applied. Farm grade fertilizers will burn more severely than fertilizers containing slow-release nitrogen. Apply fertilizer only when the grass blades are dry, and water thoroughly immediately after application.

Table 1. Approximate pounds of material (nearest ½ pound) required to supply rate of nitrogen recommended.

Pounds of nitrogen recommended	Urea 46-0-0	10-5-5 10-6-4	16-8-8	25-3-3	20-3-7 20-5-10	Natural organic 6% N	Ureaform 38% N	IBDU 31% N
½	1	5	3	2	2½	*	*	*
1	2	10	6½	4	5	*	*	3
1½	3	15	9½	6	7½	17	*	5
2	*	20	13	8	10	33½	5½	6½
2½	*	25	15½	10	12½	42	6½	8
3	*	30	19	12	15	50	8	10

*Not recommended at these rates.

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TG-7-85
horticulture guide

Turfgrass management calendar: Kentucky bluegrass lawns

This management calendar is a guide for maintaining turfgrass and helping to diagnose turfgrass problems. It is designed for central Iowa. Dates for southern Iowa are 1 or 2 weeks earlier, for northern Iowa about 1 or 2 weeks later.

Aeration—Aerify in mid-spring or fall if a compaction problem exists. Use an aerifier that removes plugs of soil. Avoid spike-type aerifiers. Break up the cores and work back into holes after the aerification has been completed. Spring aerification will require use of preemergence crabgrass herbicides.

Disease occurrence—Several diseases may infect grass plants throughout the year. Most lawn diseases are difficult for homeowners to identify and control. Cultural practices may help prevent damage to a lawn from diseases. Avoid heavy spring fertilization because high nitrogen levels favor leaf spot development. Water infrequently and use large amounts of water. Avoid later afternoon or evening watering. Remove excess thatch by power raking in early spring or fall. Use of fungicides should be delegated to a reputable lawn care company.

Fertilization—Apply 1 to 2 pounds of nitrogen per 1,000 square feet in the spring, and 2 to 3 pounds of nitrogen in the fall. Slow-release fertilizers containing water insoluble nitrogen are preferred (see Pm-1057, *Maintenance Fertilization of Turfgrasses*). When farm grade (water soluble) fertilizers are used, do not apply more than 1 pound of nitrogen per 1,000 square feet in one application.

Insect occurrence—If a lawn has had a history of billbug damage, control the adult billbug in mid-April to mid-May with Diazinon or Dursban used at recommended rates. Increased skunk, bird, or mole activity on a lawn usually indicates an insect problem, especially white grubs. Identify the insect and control it with a broad-spectrum insecticide at recommended rates.

Liming—Use lime only when a soil test shows a lime requirement. Contact your county extension director for soil testing information.

Mowing—Mow Kentucky bluegrass at 2 to 2½ inches and raise the cutting height during hot, dry weather. Mow often enough so that no more than one-third of the total leaf surface is removed. Clippings need not be removed if mowing frequency is adequate. Sharpen the mower blade on a regular basis. This provides a cleaner cut on the grass.

Seeding—Late summer to early fall is the ideal time to seed Kentucky bluegrass. Spring seedings are possible provided that irrigation is possible. Seed Kentucky bluegrass at a rate of 1½ pounds of seed per 1,000 square feet. See Pm-331 for more information on seeding home lawns.

Thatch removal—In early spring or fall, remove as much thatch as possible with a power rake. See Pm-1157 for more information on thatch control.

Renovation—Renovate damaged or thin lawns in spring or early fall. See Pm-1055 for more information.

Watering—Kentucky bluegrass will withstand periods of drought by becoming dormant. If irrigation is begun during a drought, it is necessary to continue to water throughout the duration of the drought period. Apply water infrequently, but in sufficient amounts to wet the soil to a 6-inch depth.

Weed control—Use a preemergence herbicide such as DCPA, benefin, or bensulide for crabgrass control. Apply these materials between April 15 and May 1 according to label directions. Check with your county extension office for the dates in your area. Postemergence crabgrass herbicides must be applied prior to crabgrass seedhead formation to be effective.

Spring and fall are the best times to apply postemergence broadleaf herbicides. Fall applications are preferred because there is less risk of injury to ornamentals, and weeds germinated during the summer would be killed. See Pm-930 for more information on lawn weed control.

File: Hort & L.A. 4-1

Prepared by Norm Hummel, former extension turfgrass specialist.
Revised by Michael Agnew, extension turfgrass specialist.

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Turfgrass Management Calendar for Kentucky bluegrass lawns

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Aeration					*							
Disease occurrence	Snow molds											Snow molds
					Leafspot				Leafspot			
						Dollarspot						
						Fusarium blight						
						Pythium blight						
					Stripe smut							
						Melting out						
Fertilization												
Insect occurrence				Control billbug adult		Billbug larvae						
				White grubs					White grubs			
						Sod webworm						
Liming												Best time
Mowing					As needed							
Seeding									Best time			
Sodding												
Thatch removal					*							
Watering												

TG-9-85
horticulture guide

Establishing a lawn from seed

The establishment of a home lawn is a task that should not be taken lightly. Following proper establishment procedures and planting high quality seed are the keys to successfully establishing a lawn.

Time of Seeding

The best time to seed a lawn in central Iowa is between August 15 and September 30. In northern Iowa, seed should be planted by September 15, while in southern Iowa, lawns can usually be seeded in early October with good results. Fall planting is preferred to spring and summer seeding because seeds germinate and grow rapidly in the warm soil. The warm days and cool nights are ideal for seedling growth and there is also less weed competition in fall than in early spring.

Establishment in spring and summer is possible when irrigation is available. However, lawns established in spring and summer may become infested with annual weeds unless preventive steps are taken. The additional precaution that should be taken with spring seeding is to use the herbicide siduron. Siduron is a member of a group of herbicides that have the capability of killing crabgrass and other grass weed seedlings as they germinate in the spring without damaging the established turf. Unfortunately, most of these preemergent herbicides kill the seeds of the cool season lawn grasses and cannot be used at the time of seeding. Siduron is the only exception. Siduron can be applied with bluegrass, fescues, and ryegrass at the time of seeding. The seedlings of crabgrass, foxtail, and barnyardgrass will be selectively controlled and the desirable grasses will remain unaffected. Siduron is the active ingredient of many crabgrass preventer/starter fertilizer materials. Once the barrier of siduron has been established, the soil should not be further disturbed. Wherever the barrier is broken, annual weeds will emerge.

Do not use crabgrass preventer unless it is labeled for new seedlings.

Fertilizer

Fertilization is very important at the time of seeding. This is the only time you will be able to incorporate required soil amendments or fertilizer into the root zone.

Prior to preparing the seedbed, broadcast fertilizer according to soil test recommendations, then incorporate to a depth of 4 to 6 inches. Soil testing information may be obtained from your county extension office.

Where a soil test has not been made, apply 10 to 15 pounds of 0-46-0 (triple superphosphate) or 20 to 25 pounds of 0-20-0 (ordinary superphosphate) per 1,000 square feet, and work into the soil to a 4 to 6 inch depth.

After the seedbed has been prepared and just before seeding, apply a commercial turfgrass starter fertilizer according to label directions. If a farm grade fertilizer is used, select one that is high in phosphorus, such as an 18-46-0. Apply the fertilizer at a rate to provide 1 to 1½ pounds of actual nitrogen per 1,000 square feet. Additional fertilizer at a rate of 1 pound of nitrogen per 1,000 square feet should be applied to the lawn 3 to 4 weeks after germination, when the grass is 1 to 1½ inches tall. See Pm-1057, *Maintenance Fertilization of Turfgrass,* for more information on fertilization.

Preparing the Seedbed

Preparing the seedbed is the most labor intensive and time consuming step in establishing your lawn, but it is also the most important. A well-prepared seedbed is essential for rapid, successful establishment of a lawn.

Using a rototiller or other cultivation equipment, work the soil to a depth of 4 to 6 inches, incorporating the fertilizer or other soil amendments recommended from soil test results. To prevent clodding, do not till a wet soil. Also, overtilling the soil will destroy soil structure and is undesirable.

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Rake the area to finish-grade just prior to seeding. Light rolling will indicate any low spots or irregularities in the seedbed.

Seeding

Select high quality seed of the grass species best adapted to the site. Perennial ryegrasses may be included in seed mixtures for spring and summer plantings to help the lawn establish quickly. However, for fall planting, a mixture of three or four Kentucky bluegrass varieties is preferred. The following table lists several seed mixtures and the seeding rate for each. See Pm-1067, *Which Grass Is Best for Your Lawn,* for information on selecting lawn grasses and buying seed.

Seed mixture	Seeding Rate lb/1,000 sq ft	lb/acre
100% Kentucky bluegrass	1-1½	45-65
20% ryegrass + 80% bluegrass	2-2½	85-110
50% ryegrass + 50% bluegrass	3-3½	130-150
50% red fescue + 50% bluegrass	2½-3	110-130
100% red fescue	3-4	130-175
100% tall fescue	5-7	215-300

Divide the total seed quantity in half. Sow one half in one direction and the other half at right angles to the first.

After the starter fertilizer and seed have been broadcast, lightly rake the area to cover the seed to a depth of no greater than ¼ inch. Roll the area lightly to firm the soil around the seed.

Grass seedlings are very susceptible to desiccation and the surface of a newly seeded lawn should not be allowed to dry. Water should only be applied in amounts necessary to keep the soil surface moist. Avoid overwatering and runoff.

Mulching

Mulching the lawn with clean (weed free) straw will help conserve moisture and prevent erosion. One bale of straw per 1,000 square feet will give a light mulch covering that will not have to be removed after germination. Mulching with fresh grass is not recommended.

Mowing

Kentucky bluegrass should be maintained at a mowing height of 2 to 2½ inches. As a rule, no more than ⅓ of the grass blade should be removed. The new grass should be mowed when it reaches 3 to 3½ inches in height. Mowing at this time will promote the spreading and thickening of the grass. New lawn grasses should not be allowed to grow excessively long before the first mowing. If this occurs, it will be necessary to mow the grass in stages, so as not to remove more than ⅓.

Broadleaf Weed Control

After you have completed the task of establishing your lawn, you will notice broadleaf weeds germinate along with the grass seedlings. Most broadleaf weeds can be easily controlled with a broad spectrum herbicide after the turf is established. It is safe to apply a herbicide after the lawn has been mowed at least two times. See Pm-930, *Lawn Weed Control,* for more information on lawn weed control.

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horticulture guide

Mowing your lawn

Mowing is the periodic removal of part of the turfgrass shoot. Many homeowners often do not mow their lawns properly. All too often, they remove too much of the leaves and/or wait too long between mowings.

While mowing is a basic and important factor in lawn maintenance, it may also injure plants. Each mowing temporarily stops root growth, decreases carbohydrates, increases water loss, decreases water absorption by roots, and creates ports of entry for diseases. Therefore, it is important to minimize these mowing stresses with sound mowing practices.

Factors Involved in Proper Mowing

- Mowing height
- Mowing frequency
- Clipping removal
- Mower operation

Mowing Height

Mowing height depends on the turfgrass species and environmental conditions. There are basically four turfgrass species that do well in Iowa lawns. They include Kentucky bluegrass, fine leaf fescue, perennial ryegrass, and tall fescue (table 1). Tall fescue and perennial ryegrass are bunch-type grasses with erect growth habits. These species should be mowed higher because the crown of the plant is elevated. Kentucky bluegrass and fine leaf fescue have combined prostrate and erect growth habits. The crown of the plant is relatively close to the soil surface. In lawn conditions, they will withstand lower mowing heights than the bunch-type grasses.

Increase the mowing height of cool-season turfgrasses during the stressful summer months (table 1). Higher mowing heights provide insulation to the crown of the plant against high temperatures; provide more leaf area thereby increasing photosynthesis; and will result in deeper root systems. This will enable the turfgrass to withstand periodic high-temperature stress.

The general range in mowing heights (table 1) may also depend upon cultivar differences. For instance, many Kentucky bluegrass cultivars, such as Park, Kenblue, and South Dakota Common, have more erect growth habits than many of the improved cultivars, such as Adelphi, Glade, and Midnight. Therefore, the latter three cultivars will tolerate a lower mowing height.

Each turfgrass species has an adapted range in which it tolerates mowing. This range will be lower than the recommended mowing height. Mowing below the recommended mowing height, but within the range of tolerance, requires a higher level of maintenance to maintain a healthy turfgrass stand.

Mowing below the tolerance range will result in rapid deterioration of turfgrass quality. Excessively close mowing heights will decrease the total leaf area, carbohydrate reserves, and root growth thereby creating a situation where the plants are unable to produce enough food to meet their own demands. Thus, turfgrass plants will be more susceptible to drought, high temperature, and wear injury. In addition, the bare areas created by a decrease in lawn density increase the chances of weed encroachment.

Turfgrasses can also be mowed too high. Mowing above the tolerance range will reduce tillering and cause matting of the grass. Reduced tillering results in

Table 1. Recommended mowing heights.

	Mowing height (in.)	
Species	**Cool weather**	**High-temperature stress periods**
Kentucky bluegrass*	1.75-2.25	2.25-3.25
Perennial ryegrass	1.75-2.25	2.25-3.25
Creeping red fescue	1.50-2.00	2.00-3.00
Chewings fescue	1.50-2.00	2.00-3.00
Hard fescue	1.50-2.00	2.00-3.00
Tall fescue	2.25-3.00	2.50-3.50

*In lawns where species are mixed, use the higher of the two recommendations.

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fewer and coarser plants, while matted grass creates a good microenvironment for disease development. Mowing above the tolerance range also increases thatch accumulation, which creates a need for higher maintenance and an area for overwintering insects.

Mowing Frequency

Determine mowing frequency by the grass growth rate—not by any set schedule. Remove no more than one-third of the total leaf area at any one mowing. For example, if you mow a Kentucky bluegrass lawn at a 2-inch height, the grass should be 3 inches tall. Removing more than one-third shocks turfgrass plants, which may result in temporary thinning of the turf. More important, the reserve carbohydrates within the plants are utilized for shoot regrowth, which will deplete the stored carbohydrates and reduce the capability of the plants to withstand environmental stresses. Damage to the crowns of the plants results in a stubby, brown appearance. Turfgrass plants cannot survive this amount of cutting because the shoot and roots are severed from the crown.

A grass mowed at 1 inch will require more frequent mowings than one mowed at 2 inches. If the growth rate is the same for each grass, for example ¼ inch per day, the grass mowed to 1 inch would have to be mowed in 2 days to remove only one-third of the above ground tissue, whereas the grass mowed at 2 inches would not have to be mowed for 4 days.

Table 2. Mowing frequency.

Your mowing height (in.)	Height of grass at mowing (in.)	Amount of grass removed (⅓) (in.)
1	1½	½
1½	2¼	¾
2	3	1
2½	3¾	1¼
3	4½	1½
3½	5¼	1¾

Clipping Removal

The need to remove the clippings depends on mowing frequency. If the lawn is mowed often enough, the short clippings will fall down into the turf. However, remove long clippings that remain on top of the grass. Excess clippings shade the turfgrass and create a microenvironment that favors disease development. Clippings contribute very little to thatch development because clippings are primarily water and cellulose that decompose easily. Therefore, removing clippings to prevent thatch is impractical.

Mowing Operations

Proper use of mowing equipment requires a knowledge of mowers, blade sharpness, and safety. Match your mower capacity with the size of the lawn so that the mowing can be done in a reasonable amount of time. A riding mower is appropriate if the lawn is large, flat, and full of open spaces. A walk-behind mower is more appropriate if the lawn is small with many trees.

Reel and rotary are the two basic types of lawn mowers. The reel mowers are generally more expensive and will not cut high grass, but will produce a smooth even cut on close-cut turf. The rotary mower will cost less, cut high grass, and is easy to sharpen; but it can be dangerous, noisy, and will tend to scalp uneven turf.

A sharp blade is the secret to a quality mowing job. Dull blades will shred the grass, which increases the ports of entry for disease. A dull mower blade will leave a uniform whitish cast to the lawn. Sharp blades will improve the energy efficiency of the mower by cutting more cleanly and quickly. Sharp blades are especially important for ryegrass and tall fescue.

An extra mower blade on hand will help prevent procrastination when it is time to replace the old blade.

Keep in mind that **power mowers can be dangerous and cause serious injury.** Become familiar with the equipment and use good common sense.

Safety Precautions When Mowing

- Read operator's manual.
- Remove debris from lawn.
- Keep children and pets at a safe distance.
- Keep feet and hands away from blade.
- Wear sturdy shoes and long pants.
- Operate mower at low travel speed.
- Always push mower, do not pull toward self.
- Watch footing on wet areas and slopes.
- Do not leave engine running unattended.
- Refuel engine only when it is shut off and cool.
- Stop engine and disconnect spark plug wires prior to working on blade or engine.

File: Hort & L.A. 4-1

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ISUP-68

TG-5-85
horticulture guide

Turfgrass renovation

Turfgrass renovation is a process of improving an area by seeding into the existing sod. It is a selective tillage process that falls short of completely reestablishing the turf. Lawn renovation becomes necessary when the area has been damaged to the extent that it cannot recover with standard maintenance practices, such as irrigation and fertilization.

When a lawn is damaged beyond its capability to recover, some environmental factor caused it. If the cause is not effectively dealt with, renovation will not be successful. Causes of turf deterioration may include poor drainage, thatch buildup, compaction, excessive shade, unadapted grass species, low fertility, Fusarium blight, or many other causes. Most of these problems can be corrected through renovation and proper maintenance.

The renovation method used depends on such factors as the amount of desirable permanent turfgrass species present, as well as the amount and kinds of undesirable grass or grass-like weeds and other weeds present. The thickness of thatch accumulation should also be considered.

Regardless of the method, a soil test should be made prior to starting renovation. Soil testing provides valuable information on the nutrient status of the soil at a nominal cost. County extension offices have shipping boxes, directions for taking samples, and information sheets that should be sent to the Iowa State Soil Testing Laboratory with the sample.

Early fall and spring are the ideal times to renovate lawns because the favorable weather enhances recovery. Summer renovation is not recommended.

The following are step-by-step instructions on renovating turfgrass areas for three situations.

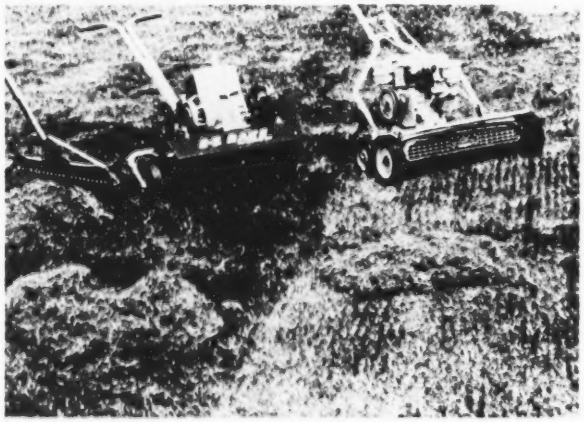
Program I

This program is designed for areas containing more than 50 percent of desirable permanent grass species, containing no other perennial grasses, and having a thatch depth not more than 1½ inches.

1. All the weeds present in the area to be renovated should be properly identified. If only easy-to-kill weeds, such as dandelion and plantain, are present, 2,4-D may be applied. The area can then be seeded 2 weeks after application. If hard-to-kill weeds, such as ground ivy or clover, are present, then 2,4-D should be applied in combination with dicamba or MCPP. A 6-week waiting period is required before seeding can begin. See Pm-930 for more information on weed control.

2. Mow the area as short as possible (¾ inch), removing all the clippings. This is to insure that the germinating seedlings obtain enough light to support their development.

3. Thatch must be removed by mechanical means. Thatch is a layer of dead stems, roots, and leaves that have accumulated between the green leaf tissue of the turf and the soil. Thatch can damage turf by restricting movement of air, water, nutrients, and pesticides into the root zone. Power rakes are available from many garden equipment rental outlets. Power rake the area in four directions (including diagonally) as many times as necessary to remove the accumulated thatch. Remove all the debris. See Pm-1127 for more information on thatch control.



Use a power rake to remove as much thatch as possible.

Prepared by Norman Hummel, former extension turfgrass specialist. Revised by Michael Agnew, extension turfgrass specialist.

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Pm-1055 | Revised | May 1985

4. If this area has had a crabgrass problem, and you are renovating in the spring, siduron (Tupersan) is an effective herbicide for preemergent crabgrass control that is safe in the seedbed. It is available to the homeowner only in starter fertilizers with crabgrass preventer (siduron). Do not use regular turf fertilizers with crabgrass killer! Apply the material according to the label directions.

5. If a starter fertilizer has been applied with crabgrass preventer, it is not necessary to apply more fertilizer at this time.

Fertilizer and lime should be applied in accordance to soil test recommendations. Where a soil test has not been made, apply 10 pounds of triple superphosphate (0-46-0) per 1,000 square feet. Immediately prior to seeding, broadcast 20 pounds of 10-5-5, 10-6-4, or 20 pounds of a 16-8-8 fertilizer, or the equivalent, per 1,000 square feet. The fertilizer must be turf grade, having an approximate 2-1-1 ratio and containing at least 35 percent of the total nitrogen as water insoluble or controlled release nitrogen. As an alternative, 7 to 8 pounds of a 13-25-12, 10 pounds of a 10-10-10, or 5 to 6 pounds of an 18-46-0 farm grade (water soluble nitrogen) fertilizer may be applied per 1,000 square feet. Use of a water-soluble fertilizer will necessitate refertilization after 6 to 8 weeks of growing weather. Work the fertilizer into the soil by dragging the area with a large doormat or piece of chainlink fence. See Pm-1057 for more information on fertilization.

6. A turf-type disk seeder is the best tool for seeding. This machine cuts grooves into the soil and deposits the seed in the groove, insuring good seed-soil contact necessary for rapid germination and establishment. When no disk seeder is available, spread the seed uniformly over the area with a drop-type seeder. The total seed quantity should be halved, sowing one-half in one direction and the other at right angles to the first.

Seed the area with high quality seed of the permanent species best adapted to the environmental conditions of your area. For sunny areas, a blend of two to five Kentucky bluegrass varieties is recommended. Improved varieties that have done well in Iowa include Adelphi, Baron, Bonnie blue, Bristol, Cheri, Glade, Majestic, Midnight, Parade, Ram I, Touchdown, and Victa. Kentucky bluegrass should be seeded at a rate of 1 to 1½ pounds of seed per 1,000 square feet. To obtain a relatively fast cover with spring seeding, Pennfine or Manhattan perennial ryegrass may be added to the mixture in amounts not to exceed 20 percent of the total mixture. Fall seedings of Kentucky bluegrass establish quickly. Therefore, bluegrass-ryegrass blends should not be planted at this time.

In partially shaded areas, use a mixture of 50 percent chewings or red fescue and 50 percent Kentucky bluegrass. Heavily shaded areas may be seeded with 100 percent chewings or red fescue at a rate of 2 pounds of seed per 1,000 square feet.

Drag the area again to work the seed into the seedbed.

7. To help retain moisture and promote germination, mulch the area with a light application of straw (1 to 1½ bales per 1,000 square feet) or reed-sedge peat. Care must be taken not to apply a layer of mulch so heavy that it smothers the existing grass.

8. Lightly irrigate the area when dry. Irrigation should only be sufficient to moisten the surface. Avoid runoff!

Program II

This program is designed for areas containing less than 50 percent of desirable grass species and having a thatch depth of not more than 1½ inches.

1. After omitting one regular mowing, apply glyphosate (Roundup®) or paraquat according to label recommendations. Allow 7 days before renovation, then follow steps 2 through 8 in Program I.

Program III

For use when thatch layer exceeds 1½ inches in depth.
1. Treat the area with glyphosate or paraquat as in Program II.

2. Seven days after glyphosate application, remove the sod with a mechanical sod cutter.

3. Till the top 4 inches of soil with a rotovator. Grade off the high spots and fill in low spots.

4. Same as step 5 in Program I.

5. Apply the seed with a drop-type seeder. Seed according to recommendations in step 6 of Program I. After seeding, lightly roll the area to place the seed in firm contact with the soil.

6. Mulch. Same as step 7 in Program I.

7. Water. Same as step 8 in Program I.

Turfgrass renovation is time consuming and expensive, and it is only the first step in having beautiful turf. A sound management program must be followed to insure continued improvement of the turf.

Mention of specific companies or brand names does not imply endorsement of a particular product.

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TG-8-85
horticulture guide

Which grass is best for your lawn?

The selection of the proper turfgrass is the most important step in the establishment of a lawn. Through proper selection, future problems may be prevented.

Grass species and cultivars vary in their range of adaptation. This variation may occur from one part of the country to another, as well as from one part of the state to another.

The grass that is best for your lawn will depend on
1. Your quality standards,
2. The amount of maintenance you are willing to provide,
3. The amount of shade, and
4. How the lawn will be used.

Quality vs. Maintenance

Everyone has ideas about what a quality lawn should be. The beautiful, dark green Kentucky bluegrass lawn that is the pride of the neighborhood is probably the most expensive and time consuming lawn to maintain. At the other extreme is the tall fescue lawn that is coarse in texture, light in color. This lawn, however, requires less watering, thatch control, and fertilization.

The needs of most people are probably between these two extremes, but balancing maintenance and quality is an individual decision that should be carefully considered.

Maintenance Requirements

Least	Tall fescue
	Fine fescue
	Zoysiagrass
	Bluegrass
Most	Ryegrass

Maintenance level can be categorized by the amount of nitrogen, irrigation, and thatch control that is received in one year.

Cultural Practice	Maintenance Level Low	Medium	High
Nitrogen (lb/yr)	1-2	2.3-3.5	4-5
Irrigation	No	Maybe	Yes
Thatch control	No	Maybe	Yes

Maintenance level will vary among different cultivars of Kentucky bluegrass. The new improved types of Kentucky bluegrass (table 1) require a medium to high maintenance level. There are several cultivars that have performed well under low maintenance levels (table 2). However, most of these do not perform well under high maintenance.

Amount of Shade

One of the most frequent causes of turf deterioration is shade. Grass species differ in their ability to tolerate shade. Before selecting the grass for your lawn, consider the amount of shade the grass will be subjected to now and as the trees grow.

Shade Tolerance of Grasses

Least	Zoysiagrass
	Bluegrass
	Ryegrass
	Tall Fescue
Most	Fine Fescue

Type of Lawn Use

How your lawn is used will have a big influence on the grass you select. If your lawn is used mainly for show, wear resistance may not be an important consideration. If the lawn gets frequent family or neighborhood use, select a grass or mixture of grasses that will resist wear and recover quickly.

Wear Resistance		Recuperative Ability
Fine fescue	Low	Zoysiagrass
Bluegrass		Ryegrass
Ryegrass		Tall fescue
Tall fescue		Fine fescue
Zoysiagrass	High	Bluegrass

Prepared by Norman Hummel, former extension turfgrass specialist. Revised by Michael Agnew, extension turfgrass specialist, and Nick Christians, associate professor of horticulture.

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Pm-1067 | Revised | October 1985

Grass Species

Kentucky bluegrass is the best adapted turfgrass in Iowa for lawns. Kentucky bluegrass is dark green in color and has a medium texture. The leaves are smooth, soft, and have good mowing quality. Bluegrass will form a tightly knit, attractive sod due to its ability to spread by underground stems (rhizomes). It should be maintained at 2 to 3 inches, but will tolerate lower mowing on high maintenance areas. It grows best on heavy, well-drained, fertile soils and will tolerate partial shade. Water requirements are high during the actual growing season, but during hot, dry spells Kentucky bluegrass will escape drought by going dormant. Kentucky bluegrass will recover rapidly when an adequate amount of moisture is supplied. It has moderate wear resistance but recovers quickly from damage.

Kentucky bluegrass is susceptible to *Fusarium* blight and the leaf spot diseases. Improved varieties of bluegrass are more resistant to these diseases than the common types. Select a seed mixture that contains at least two improved bluegrass varieties. Bluegrass varieties that have done well in Iowa are listed in table 1.

Perennial ryegrass is a bunch-type grass that is used in seed mixtures primarily because of its ability to germinate and establish quickly. It is medium to coarse in texture and dark green in color. Ryegrass leaves are heavily veined with a glossy underside. Ryegrass should be maintained within the 2 to 2½ inch mowing height range.

Ryegrass does not tolerate extremes in temperature, and therefore is not recommended for pure stands in Iowa. However, because of its exceptional durability and rapid establishment, improved varieties are blended with bluegrasses to provide a wear resistant turf on heavily used areas.

Ryegrass is fairly shade tolerant. It grows well on a wide range of soils and has good tolerance to wet soils.

Improved ryegrass varieties for use in blends are listed in table 1.

Table 1. Recommended turfgrass varieties for Iowa.

Kentucky bluegrass	Perennial ryegrass
Adelphi	Manhattan
Baron	Manhattan II
Bonnieblue	Citation
Bristol	Derby
Cheri	Diplomat
Eclipse	NK 200
Glade	Palmer
Majestic	Pennfine
Merit	Prelude
Midnight	Regal
Nassau	Yorktown
Parade	
Ram I	
Touchdown	
Victa	

Table 2. Recommended Kentucky bluegrass cultivars for low maintenance.

Argle	Plush
Fylking	Ram-1
Kenblue	South Dakota common
Monopoly	Vantage
Mosa	Wabash
Piedmont	

Fine fescue is the general name given to a group of fescue species characterized by having very fine leaves. Creeping red fescue, hard fescue, and chewings fescue are used in blends for shaded conditions. They are superior to most cool season grasses in shade adaptation and are compatible in mixes with Kentucky bluegrass. Like ryegrass, fine fescues germinate and establish quickly.

Fine fescues form a very fine-textured turf of high shoot density. They are medium to dark green in color and spread by tillers and rhizomes. Drought tolerance is superior to blue grass. However, during periods of hot, dry weather, the fine fescue may lose its color rapidly. Fine fescues should be mowed regularly at 2 to 2½ inches and will respond well under a low fertilization program.

Improved varieties of fine fescues include Pennlawn, Ensylva, Dawson, and Fortress red fescue; Shadow, Jamestown, and Atlanta chewings fescue; and Biljart, Scaldis, and Reliant hard fescue.

Tall fescue is the most heat and drought tolerant of the cool season grasses. It is often used where a low maintenance lawn is desired. It will form a deep root system that is well adapted to clay, wet, or alkaline soils.

Tall fescues are medium to dark green in color and are very coarse textured. They are bunch-type grasses that must be thickly planted to form a good sod. Overseeding every two years is recommended to reduce the coarse, clumpy appearance of tall fescue grass.

When tall fescue is maintained at 3 inches, weeds will rarely be a problem. There are few serious disease or insect problems with tall fescue, and thatch is rarely a problem unless the lawn is overwatered or overfertilized. Tall fescue is a fast growing grass, so more frequent mowing will be required. Finer leaved tall fescue varieties, such as Rebel, Mustang, Hounddog, and Falcon, have been released in recent years. These cultivars are somewhat finer in texture than other tall fescues and may provide advantages over the older cultivars.

Zoysiagrass is a medium textured, slow-growing, warm season grass that spreads by rhizomes and aboveground runners (stolons). It is more cold tolerant than most warm season grasses; however, it remains in a straw-colored state of dormancy for 8 months a year in Iowa. Zoysia is very heat and drought tolerant. Another factor limiting the use of zoysiagrass in Iowa is its slow establishment rate. However, once established, zoysiagrass forms a very dense, weed resistant sod. Thatch buildup is a serious problem with zoysia, so regular dethatching is necessary.

Zoysiagrass grows best on well-drained, slightly acid, medium-textured soils of moderate fertility. It does not tolerate poorly drained soils.

When properly managed, established zoysiagrass will form a very attractive, dense, high quality lawn. Meyer is the most widely used zoysiagrass cultivar. It can only be established from sod, sprigs, or plugs.

Buffalograss is a fine-textured, grayish-green grass native to the western Great Plains. It is adapted to a wide range of soil conditions, but is exceptionally well suited to fine textured, alkaline soils. Buffalograss spreads by stolons, but it will not form a dense, high quality sod. It requires low nitrogen, no irrigation, and full sun. Unfortunately, most parts of Iowa will receive too much rainfall to make this turfgrass a practical choice.

Buffalograss may be established from seed, sod, sprigs, or plugs. It is very slow to establish, and may take 2 years or more to form a sod. Weeds are often a serious problem during establishment. Avoid overwatering and overfertilizing during the establishment years because these practices will favor weeds.

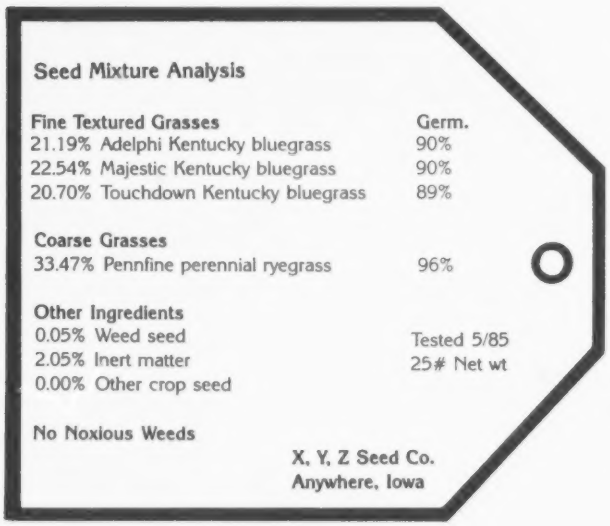
Improved varieties of buffalograss include Sharp's and Texoka.

Purchasing Seed

When you have decided which grass is best for your lawn, you will want to purchase **high quality** seed. Garden center shelves contain a wide range of seed choices. Unfortunately, many of these are low quality, inexpensive blends. When you consider the amount of work necessary to establish a lawn, and the longevity of the lawn produced, the investment of purchasing high quality seed is very small. A lawn established with the right seed mixture means less trouble and expense in years to come.

Read the Seed Label

Understanding what goes into a seed mixture will help you in selecting the right seed mixture and making the best investment for your home lawn. Seed packages are required by law to list on a label an analysis containing important information about the seed. An example of a seed label is shown below.



Seed Mixture Analysis

	Germ.
Fine Textured Grasses	
21.19% Adelphi Kentucky bluegrass	90%
22.54% Majestic Kentucky bluegrass	90%
20.70% Touchdown Kentucky bluegrass	89%
Coarse Grasses	
33.47% Pennfine perennial ryegrass	96%
Other Ingredients	
0.05% Weed seed	Tested 5/85
2.05% Inert matter	25# Net wt
0.00% Other crop seed	

No Noxious Weeds

X, Y, Z Seed Co.
Anywhere, Iowa

The principal factors influencing seed quality are purity and germination. Purity is the percentage of pure seed of an identified species or cultivar present in that lot of seed. For example, 21.19 percent of the sample mix is Adelphi Kentucky bluegrass seed. Germination is the percentage of seed that is alive and will germinate under standard laboratory conditions. Since seed will lose its viability with time, the date of germination testing is listed on the label and should be noted. Multiplying the germination by purity and dividing by 100 gives the percentage of pure live seed (PLS) (germ % x purity % ÷ 100 = % PLS). Using the sample seed mix:

Adelphi	(21.19% × 90%) ÷ 100 =	19.07% PLS
Majestic	(22.54% × 90%) ÷ 100 =	20.28% PLS
Touchdown	(20.70% × 89%) ÷ 100 =	18.42% PLS
Pennfine	(33.47% × 96%) ÷ 100 =	32.13% PLS
		89.9% PLS in this mix

Next, divide the cost per pound of seed by the percentage PLS, then multiply by 100 to yield the actual cost of pure live seed. If this sample mix cost $2.25 per pound, then $2.25 ÷ 89.9% × 100 = $2.50 per pound PLS. By making these simple calculations when shopping for seed, you can compare two or more packages of seed to determine which is the best buy.

When purity is less than 100 percent, the remaining percentage is composed of weed seed, inert matter, and other crop seeds. **Weed seed** refers to undesirable plant species not normally grown as a farm crop, such as chickweed. The lower the percent weed seed, the better the quality of the seed. **Noxious weeds** are those that are officially declared as special problem weeds, such as quackgrass. Select a seed mix that contains no noxious weeds. **Other crop seeds** are plants that are normally grown for profit. These plants may include very difficult weeds to eradicate, such as bromegrass or orchardgrass. Puchase seed that contains no other crop seeds. **Inert matter** includes anything that is not seed, such as soil, stems, or detached hulls. Obtain a seed mix with a low percent inert matter. The label also contains the name and address of the seed packer responsible for the contents of the mix as it is specified on the label.

Selecting the right grass, and purchasing quality seed are only the first steps to establishing your lawn. Following proper establishment procedures and a sound maintenance program are equally important in having a beautiful lawn.

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TG-10-85
horticulture guide

Calibration and maintenance of a fertilizer spreader and lawn area calculation

There are two types of spreaders available: the drop-type or gravity spreader, and the rotary or broadcast spreader. The one you choose depends upon its use. For example, you should use a drop-type spreader when making applications of herbicides, since many ornamental plants are sensitive to herbicides used on the home lawn. Seed, too, is more accurately applied with a drop-type spreader. Fertilizers, however, can be rapidly and accurately applied with a broadcast spreader.

Equipment needed for calibration
- Scale that measures in ounces.
- Broom and dust pan.
- Sheet of plastic.

The Drop-type Spreader

A drop-type spreader is one in which the fertilizer exits through a series of openings at the base (figure 1). The size of the openings can be adjusted to obtain different rates of application. Since all the fertilizer falls within the wheel base, slight overlapping of the wheels with each pass is necessary to ensure uniform coverage. Common problems associated with drop spreaders include skips between application strips as well as excessive overlapping. However, with proper calibration and operation, drop spreaders can apply granular fertilizers and pesticides very accurately.

To Calibrate

Locate a smooth, flat area without deep cracks, on the driveway or in the garage. Sweep a section about 5 by 12 feet to remove small stones and other debris. If a smooth area cannot be found, place a 4- by 12-foot piece of plastic on the ground, securing the corners with heavy objects. Mark an area 10 feet long with a piece of chalk or marking pencil.

Fill the spreader with material to be spread on the lawn. Set the spreader at a middle setting. Walk at normal speed across the 10-foot strip, turning on the spreader at the first mark and shutting it off at the second. Sweep the fertilizer that was dropped by the spreader, then weigh it on a kitchen scale. Record this weight in ounces.

Determine how much material should have dropped on the strip, if the proper rate was applied. This step involves a few simple calculations:

1. Determine the amount of material (A) to be spread per 1,000 square feet. This should be converted from pounds to ounces (1 pound = 16 ounces).

2. Determine the total area (B) to be covered by the spreader in the 10-foot test strip i.e. 10 ft. (length of test strip) × 3 feet (width of spreader) = 30 square feet.

Figure 1. Drop-type spreader.

Prepared by Mike Agnew, extension turfgrass specialist, and Nick Christians, associate professor of horticulture.

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3. Set up the proportion with (C) equaling the amount of material that should fall from the spreader.

$$\frac{\text{(A) ounces}}{\text{1,000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{(B) sq. ft.}}$$

$$\text{where (C)} = \frac{\text{(A)} \times \text{(B)}}{\text{1,000 sq. ft.}}$$

The answer calculated in step 3 (C) should equal the weight of fertilizer dropped on the sample strip. If the recorded weight is less than the calculated value, repeat this procedure with the spreader set to a larger opening. If the weighed value is more than the calculated value, the spreader opening should be smaller. Don't get frustrated if the two values don't agree at first. It may take two or three adjustments in spreader settings before the spreader is properly calibrated.

Example: A 50-pound bag of 33-0-0 is to be applied to a lawn at a rate of 1 pound of nitrogen per 1,000 square feet. This would require 3 pounds of 33-0-0 per 1,000 square feet (see Pm-1057 for recommended fertilizer rates and procedures). A 36-inch spreader is to be used. Convert pounds to ounces. Thus, 3 pounds = 48 ounces.

1. (A) = 48 ounces of 33-0-0 per 1,000 square feet.

2. (B) = 10 feet (length) × 3 feet (width) = 30 square feet.

3. $\frac{\text{48 ounces}}{\text{1,000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{30 sq. ft.}}$

$$\text{where (C)} = \frac{\text{48 ounces} \times \text{30 sq. ft.}}{\text{1,000 sq. ft.}}$$

(C) = 1.44 ounces.

The spreader should have dropped close to 1½ ounces of fertilizer on the test strip if it is properly calibrated. If not, readjust the setting and try again. Continue this trial and error procedure until the spreader consistently delivers the desired amount of fertilizer. Then record the setting for future use.

It is important to understand the relationship between the setting number and the amount of fertilizer dropped. A spreader setting of 10 does not mean the machine will spread twice as much fertilizer as with a setting of 5. It will probably be closer to 4 times as much. Keep this in mind when changing the spreader setting.

What About Seeding?

The procedure for calibrating a drop-type spreader for a seeding rate is essentially the same as that for fertilizers, except for the following: (A) In step 2, use a 50-foot test strip instead of a 10-foot test strip. This is done to insure that enough seed can be collected to weigh on a common kitchen scale. (B) In step 3, divide the answer (C) by 2.

This number actually represents half the recommended seeding rate. Proper establishment involves seeding the lawn twice, sowing half the seed in one direction and the other half at right angles to the first (figure 2). See Pm-1072, *Establishing a Lawn From Seed,* for recommended seeding rates and procedures.

Example: To seed a Kentucky bluegrass lawn, the recommended seeding rate is 1½ pounds or 24 ounces of seed per 1,000 square feet. A 24-inch spreader will be used.

1. (A) = 24 ounces of seed per 1,000 square feet.

2. (B) = 50 feet (length) × 2 feet (width) = 100 square feet.

$$\frac{\text{24 ounces}}{\text{1,000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{100 sq. ft.}} \text{ where}$$

$$\text{(C)} = \frac{\text{24 ounces} \times \text{100 sq. ft.}}{\text{1,000 sq. ft.}} = 2.4 \text{ ounces}$$

2.4 ÷ 2 = 1.2 ounces.

The spreader should drop about 1¼ ounces of seed on the 50-foot test strip if it is properly calibrated.

The Rotary Spreader

Rotary spreaders are very efficient for fertilizing large lawns. Fertilizer drops out of one or more adjustable openings onto a rotating plate (figure 3) and is spread in a semicircular arc due to the centrifugal force of the rotating plate.

Uniform distribution is a problem with rotary spreaders but it can be controlled by overlapping. To uniformly spread a fertilizer, apply half of the material in one direction, and the other half at right angles to the first (figure 2). This means that when the rotary spreader is calibrated it will be for half the recommended rate.

Calibrate for Half Rate

Partially fill the spreader with fertilizer and mark the level on the side of the hopper. With the spreader set at a middle setting, operate it over an area of known dimension. For example, if the spreader has a 6-foot spreading swath and it is operated for 50 feet, it will have covered 300 square feet (6 × 50 = 300).

Next, place a pliable piece of plastic or cloth on the inside of the hopper. Pour fertilizer into the hopper until it has reached the marked level. Then remove and weigh the amount of fertilizer that was added to refill the hopper to the marked level. Record the weight in ounces.

To determine how much fertilizer should have been spread on the known area:

1. Determine the amount of material (A) to be spread per 1,000 square feet.

2. Determine the total area (B) to be covered with fertilizer, i.e. 50 feet (length of test area) × 6 feet (width of spreader swath) = 300 square feet.

3. Set up the proportion with (C) ÷ 2 equaling the amount of material that should fall from the spreader.

$$\frac{\text{(A) ounces}}{\text{1,000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{(B) sq. ft.}} \text{ where}$$

$$\text{(C)} = \frac{\text{(A)} \times \text{(B)}}{\text{1,000 sq. ft.}} \text{ and (C)} \div 2 =$$

Amount of fertilizer that should be added to hopper.

The final answer should equal the weighed fertilizer. If the weighed value is less than the calculated value, set the spreader with a larger opening and repeat the procedure. If the weighed value is more than the calculated value, the spreader opening should be smaller. Don't get frustrated if the two values don't agree at first. It may take five or six adjustments in spreader settings before the spreader is properly calibrated. After calibration has been completed, record the setting for future use. Be sure to recheck the setting each time new fertilizer is purchased.

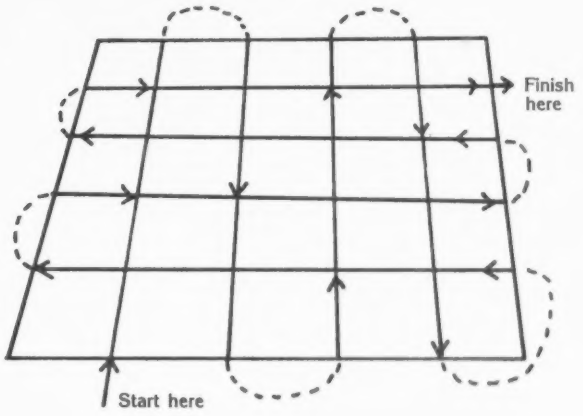


Figure 2. Pattern for fertilizing or seeding lawn with a rotary spreader.

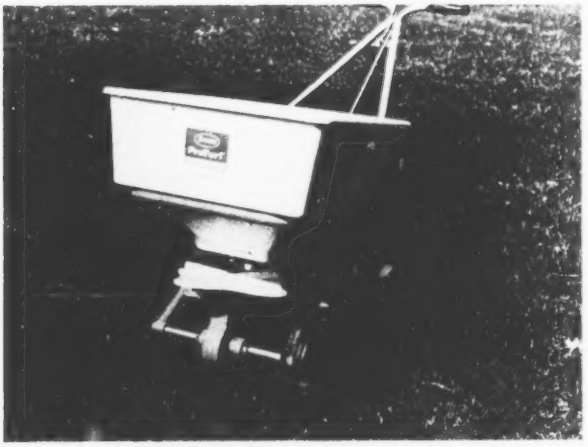


Figure 3. Rotary spreader.

Example: A 30-pound bag of 16-2-2 fertilizer is to be applied to the lawn at a rate of 1 pound of nitrogen per 1,000 square feet. This would require 6 pounds or 96 ounces of 16-2-2 per 1,000 square feet (see Pm-1057). The spreader has a 6-foot spreading swath. Calibrate it by walking 25 feet.

1. (A) = 96 ounces of 16-2-2 per 1,000 square feet.

2. (B) = 25 feet (length) × 6 feet (spreader swath) = 15 square feet.

$$3. \quad \frac{\text{96 ounces}}{\text{1,000 sq. ft.}} = \frac{\text{(C) ounces}}{\text{150 sq. ft.}}$$

where (C) = 14.4 ounces
14.4 ÷ 2 = 7.2 ounces.

What About Seeding?

Rotary spreaders are not recommended for seeding home lawns. It is nearly impossible to spread Kentucky bluegrass seed uniformly with a rotary spreader due to the small seed size. A drop-type spreader is preferred.

Spreader Maintenance

A properly maintained fertilizer spreader will last longer and provide more uniform coverage of foliage. The following steps should prove useful in the proper maintenance of a fertilizer spreader.

1. After using the fertilizer spreader, it is important to remove all excess material from the spreader. Never store unused material in the hopper.

2. Thoroughly wash the inside of the hopper as well as surrounding external surfaces.

3. Dry the spreader. This is especially important for metal spreaders and metal parts of the spreader. This will minimize rust formation. The development of rust near the openings can severely affect the uniformity of fertilizer application.

4. Apply a thin layer of oil to exposed metal surfaces. This will protect the metal from rusting. Be sure not to forget to oil the wheels.

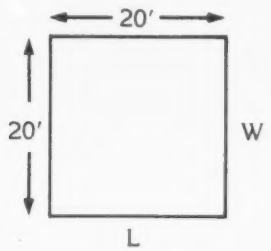
5. Check for worn or broken parts. Replace those parts prior to next use.

Area Calculation

It is important to calculate accurately the area of the lawn where fertilizer or seed will be applied. This will help you purchase the correct amount of fertilizer or seed. Follow the examples below on how to calculate the area of various area shapes.

Rectangle or square

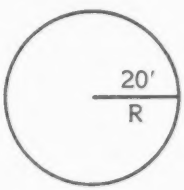
Area = Length (L) × Width (W)



Example: Area = (20′) × (20′) = 400 sq. ft.

Circle

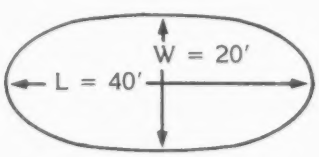
Area = π × Radius (R) × Radius (R) where π = 3.14



Example: 3.14 × (20′) × (20′) = 1,256 sq. ft.

Oval

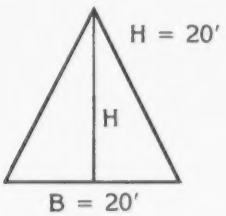
Area = Length (L) × Width (W) × .8
where L and W are measured at midpoint



Example: (40′) × (20′) × .8 = 640 sq. ft.
This area determination is accurate to within 5 percent.

Triangle

Area = .5 × Base (B) × Height (H)



Example: = .5 × (20′) × (20′) = 200 sq. ft.

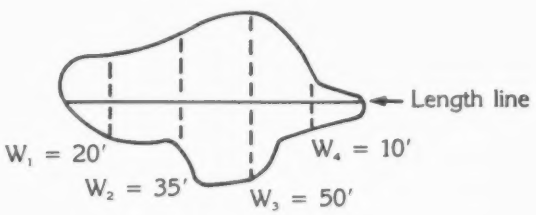
Irregular Shape

1. Determine the longest axis of the area (length line).

2. Mark out 10-foot increments along the length line, and measure the width (W) at right angles.

3. Total all widths and multiply by 10. This will determine the area to within 5 percent.

Area = (W_1 + W_2 + W_3 + W_4) × 10



Example: Area = (20′ + 35′ + 50′ + 10′) × 10 = 1,150 sq. ft.

Final Note on Calibration

Changes in walking speed will change the calibration of both drop-type and rotary spreaders, so make sure that walking speed is the same when fertilizing the lawn as it was when the spreader was calibrated.

Also, not all fertilizers and pesticides are alike, so spreader settings will change when different materials are used. For example, the setting used for the "weed and feed" applications in the fall will probably be different from that used for the "crabgrass preventer" in the spring. The spreader will have to be recalibrated each time a new material is used.

As a final step, it is very important that the calibration be checked by comparing the actual application rate on the lawn against the calculated rate. Further adjustment may be necessary at that time.

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ISUP-68

TG-11-84
horticulture guide

Thatch control in the home lawn

Thatch is a tightly intermingled layer of dead and living stems, leaves, and roots that forms between the soil surface and green vegetation. Thatch development is normal in home lawns. However, excessive amounts of thatch may be detrimental.

Why worry about thatch

There are many reasons why homeowners should try to prevent thatch from forming. When thatch is present in excessive amounts (greater than ½ inch), it may make up the primary growth medium. This means that most of the grass roots will be growing in the thatch, not the soil. Since thatch is not capable of holding much water, the grass will be more susceptible to drought. Also, thatch does not offer roots or grass crowns much protection from temperature extremes. Therefore, direct low and high temperature kill of grasses is more likely to occur on thatchy lawns.

An increase in the incidence of diseases such as Fusarium blight, Pythium blight, and leafspot has been shown to be associated with an increase in thatch. Thatch also provides an ideal habitat for the overwintering of sod webworm and adult billbug. In fact, sod webworms have great difficulty surviving in bare soil, so thatch is very important to continued populations of this insect.

Finally, the effectiveness of certain pesticides and the efficiency of fertilizers are greatly hampered when thatch is present in excessive amounts.

Thatch control

Thatch control is not just a once-every-five-year power raking. Instead it is an integrated approach involving prevention, biological control, and mechanical removal.

Prevention

Thatch prevention first requires understanding what causes thatch to form. Thatch accumulates when the rate of shoot production exceeds the rate of microbial decomposition.

Heavy nitrogen fertilization and irrigation will promote thatch development. This is why the nicest lawns in the neighborhood are often the first to have thatch-related problems. Fertilizer and water should be adequate enough to maintain good growth, but not so excessive as to produce succulent, unnecessary growth. Excessive irrigation can further aid in thatch accumulation by creating waterlogged conditions that inhibit breakdown of the thatch by microorganisms.

Infrequent mowing of tall grass will also contribute to thatch accumulation. This does not mean, however, that grass clippings should always be removed. Research has shown that grass clippings are a valuable source of nutrients and that **they do not contribute to thatch** if the lawn is mowed at proper intervals.

Grass species and even cultivars will influence thatch. Certain grasses tend to thatch faster than others—some because of their vigorous growth habit, others because of the resistance of their plant tissue to decomposition. Some Kentucky bluegrass cultivars are notorious thatch producers due to their vigorous growth habit. Fine fescues are slow-growers, but their leaves and other plant parts are very resistant to decomposition. Where vigorous bluegrass cultivars are used, mowing at a shorter height (1½ inches) will retard shoot production.

Biological control

Fungi, bacteria, and other soil microorganisms actively decompose certain components of thatch. Earthworms and insects also help control thatch by mixing soil into the thatch and improving soil aeration. It is possible for homeowners to alter the soil environment so as to promote microbial activity and enhance thatch decomposition.

Thatch will break down more rapidly if the microenvironment within the thatch favors increased activity of microorganisms. Factors influencing microbial activity include temperature, moisture, aeration, pH, and inorganic nutrient supply.

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Cultivation by core aerification is a practice that can greatly improve the micro-environment. Core aerification involves using a machine that punches a hollow tine into the soil, removing a small soil core. The soil is then deposited on the surface of the thatch. This mixing of the soil with thatch improves moisture and temperature relations. This, plus the improved aeration, increases microorganism activity. Adequate irrigation and fertilization will also increase microbial activity and aid in thatch decomposition.

Core aerification should not be looked upon as a method of removing large amounts of thatch. Rather, it is most effective as a means of preventing thatch from developing. Homeowners who have lawns receiving high maintenance should seriously consider annual core aerification.

Mechanical removal

The only effective means of removing large quantities of thatch is mechanical removal. Vertical mowing or power raking is the most common method used. When severe vertical mowing is necessary, at least three to four weeks of good growing weather should follow in order for the lawn to recover. In Iowa, early fall is the best time to power rake a lawn. Lawns can be power raked in the spring; however, competition from annual grasses such as crabgrass will be much greater. If it is necessary to power rake a lawn in spring, be sure to follow with an application of a good preemergence herbicide to control annual grasses. Do not power rake after applying a preemergence herbicide because the herbicide barrier will be broken.

Applying a light rate of fertilizer following power raking will help the grass recover from injury.

Lawns with a serious thatch problem may require a severe power raking each fall until thatch depth is less than ½ inch. Then an integrated program of preventive methods may be used. If the lawn has more than 1½ inches of thatch, it will be necessary to have the sod stripped off. The lawn may then be reestablished from seed or sod.

Miracle products

Research at several universities has shown that "miracle dethatching agents," which can be easily sprayed on a lawn, are ineffective in breaking down thatch.

File: Hort & LA 4-1

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ISUP-68

Lawn weed control

TG-3-85
horticulture guide

Controlling weeds in turf areas is one of the primary concerns of lawn care personnel and homeowners. The methods used for controlling weeds have changed dramatically in the last 20 years with the introduction of modern herbicides. These chemicals allow the selective removal of most weeds from established turf with minimal risk of injury to the turfgrass. Unfortunately, with the advent of chemical control, many people have become dependent upon herbicides and often neglect the cultural strategies developed before herbicides were introduced. Weeds in a lawn are often a sign of a weak turfgrass stand. Merely killing the weeds with a herbicide removes the symptom without curing the cause. This publication is intended to review the principles of maintaining a healthy, competitive turf along with describing the various methods of weed control. More detailed information regarding many of the cultural practices is available in other extension publications.

Cultural Weed Control

Cultural control strategies are based on producing a vigorous stand of turf that will be able to crowd out the majority of weeds. Maintaining a competitive turf is by far the most important aspect in preventing continual weed problems. Weeds are often the result of improper cultural practices that stress the turfgrass and give weeds a competitive edge. Improper mowing, poor selection or misapplication of fertilizers, heavy traffic resulting in compacted soils, thatch buildup, or damage to the turf by insects or diseases can lead to weed infestations. Before attempting to control weeds, it is important to identify and correct the problems that have allowed the weeds to become established in the turf.

Selection of turf species and cultivars. Grass species used in turf have been selected for their ability to withstand foot traffic and frequent mowing. These species should be able to prevent most weeds from invading the grassy area when given proper care. Most turf species used in Iowa are cool-season grasses that grow best when temperatures do not exceed 80°F. Kentucky bluegrass, bentgrass, and tall fescue are examples of cool-season grasses. Because cool-season grasses often undergo heat stress during the summer in Iowa, weeds adapted to high temperatures frequently become problems. A few warm-season turfgrasses are hardy enough to survive Iowa winters and are occasionally used in lawns. Zoysiagrass is the most common warm-season species used in Iowa. Although Zoysia is better adapted than bluegrass to the high temperatures occurring during July and August, it remains dormant during much of the spring and fall.

Whenever establishing a lawn or overseeding an area, choose high quality seed of a well-adapted turf species to insure rapid establishment and prevent the introduction of weed seeds. Lawn seeding should be done either in the early fall or spring to allow the seedling grasses to become established before the onset of summer.

Refer to Pm-1067, *Which Grass Is Best for Your Lawn?*, and Pm-1072, *Establishing a Lawn from Seed*, for more information on turf establishment.

Mowing. Lawns should be mowed regularly so that no more than one third of the total height is removed on a single mowing. The optimum height for mowing varies with different turf species. Kentucky bluegrass performs best when maintained at 2 to 2.5 inches. It is important to keep a sharp edge on the mower blade to minimize injury to the turf.

Fertilization. Fertilizers provide the nutrients required to maintain active growth of the turf. Selection of an appropriate product and proper timing of application is essential to gain full benefit from these materials. Fertilizer should be applied to bluegrass and other cool-season species during the spring or fall while the turf is actively growing. Summer fertilization tends to promote weed growth since the turf is unable to utilize the nutrients.

Refer to Pm-1057, *Maintenance Fertilization of Turfgrasses*, for more information on fertilization.

Watering. A homeowner or grounds maintenance supervisor must make the decision whether to water throughout the summer or to allow the turf to go into dormancy. Watering should be infrequent and should wet the soil to a depth of 4 to 6 inches. Frequent light waterings leads to a development of a shallow turf root

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system and promotes the germination of weed seeds. If irrigation is begun during a dry period, it is important to continue watering throughout the drought. Severe damage may be done to the turf if irrigation is stopped midway through late summer.

Aeration and Dethatching. Turf requires a favorable environment in which to establish a vigorous root system. Two problems frequently encountered in the root zone are compacted soils and thatch accumulation. Soils along roads, driveways, and sidewalks often become compacted and weaken the turf stand. Compacted soils restrict root growth and inhibit oxygen and water movement. The presence of knotweed in a lawn is often an indicator of compacted soils.

Thatch is an accumulation of organic matter at the soil surface. When thatch exceeds an inch in depth, the roots of the turf may become concentrated in this layer. Because the thatch layer fluctuates widely in temperature and moisture levels, it makes a poor rooting medium.

A wide variety of equipment is available to aerify and dethatch lawns. It is best to use this equipment in the fall since they temporarily thin the turf. The fall timing will allow the turf to recover quickly and prevent weed problems from developing.

Refer to Pm-1055, *Turfgrass Renovation*, and Pm-1127, *Thatch Control in the Home Lawn*, for more information on dethatching.

Mechanical Weed Control

Mechanical weed control includes methods that physically remove the undesirable plants. Mowing eliminates a wide variety of plants, such as velvetleaf and lambsquarters, which have upright growth habits. Manually removing plants by pulling or digging is an efficient means of control in small lawns or when only a few weeds are present. Perennial weeds that have extensive root systems may not be controlled unless the entire root system is removed.

Chemical Weed Control

Although cultural and mechanical measures can greatly reduce weed problems, it may be necessary at times to supplement these strategies with herbicides. Careful selection and application of these chemicals can effectively control a variety of weeds with little risk or injury to the turf or nearby ornamental plants. Herbicides cleared for use by homeowners have been selected for their low toxicity to humans and other animals. However, proper caution should be used when handling any pesticide to minimize exposure to the herbicide by the applicator and other people in the area.

Because most herbicides are fairly specific in which weeds they will kill, the first step in using a herbicide is to identify the weeds present in the turf area. See the sketches of weeds commonly found in turf at the end of this publication. If you are unable to identify the weed, take a sample of the plant to your county extension office or to a local garden store. Selecting an appropriate herbicide is impossible until you learn the correct identification of the weed.

It is also important to know the life cycle of problem weeds. Annual weeds, such as crabgrass and knotweed, begin growth each spring from seed and mature at the end of the growing season. Because these weeds are killed by the first frost, it is usually of little benefit to spray these weeds in the fall.

Shepardspurse and pepperweed are winter annuals that germinate in the late fall and overwinter in an immature stage. They resume growth in the early spring and flower before summer. Winter annuals are best controlled during warm periods in late fall or in early spring before seedheads develop. Biennials require 2 years to complete their life cycle. Best control is obtained during the first year of growth while the plant forms a basal rosette. The last type of life cycle is the perennial—these plants live for more than 2 years. They often are the most difficult type of weed to control because many perennials have extensive root systems. Best control of these plants is often obtained during the fall after the weeds have recovered from the stress of summer and are storing reserves in their roots for the winter.

Herbicides

Preemergence treatments are used to control annual grass and broadleaf weeds. They must be applied before the weed seeds germinate and are not effective on emerged weeds. With the exception of siduron (Tupersan), most preemergence herbicides will also inhibit the emergence of lawn grass seed and cannot be used simultaneously with lawn grass seeding.

Postemergence treatments are used for the control of emerged annual, biennial, and perennial weeds. Postemergence controls for annual grasses are not nearly as effective as preemergence controls and hurt bluegrass nearly as much as the weeds when temperatures are above 85°F. Postemergence control of both annual grass and broadleaf weeds should be initiated early, before the weeds are much beyond the seedling stage, that is one- to three-leaf stage for grasses or five- to seven-leaf stage for broadleaf weeds. The effectiveness of postemergence chemicals is reduced as weeds become larger.

Postemergence treatments for the control of biennial and perennial weeds are generally most effective when applied in spring to early summer or fall. Whenever possible, fall applications are preferred to spring or summer applications because of the much lower risk of injury from herbicide spray or vapor drift onto desirable ornamental and garden plants. Dicamba (Banvel) and ester formulations of 2,4-D and MCPP will vaporize under the higher temperature and humidity conditions of May, June, and July. By restricting spring and summer applications to spot treatments and using nonvolatile amine salt formulations of 2,4-D and MCPP, the risk of injury to desirable plants in both your and your neighbors' yards will be reduced.

Herbicides may be classified into one of two types depending on their effect on plants: contact (non-selective) or systemic.

Contact herbicides kill only the portion of the plant wetted by the spray solution. Due to the lack of movement of the herbicide in the plant, it is important to get good spray coverage. Best control is obtained when weeds are sprayed while they are small. Contact herbicides are not effective against perennials. Paraquat, Basagran, Buctril, and DSMA are contact herbicides registered for use in turf.

Systemic herbicides are absorbed by plant roots or above-ground parts and are translocated throughout the plant. They are either selective (kill weeds without harming desirable grasses) or non-selective (kill all plants). 2,4-D and MCPP are selective systemic herbicides useful in controlling many broadleaf weeds that invade turf. Glyphosate (Roundup or Kleenup) is a non-selective systemic herbicide capable of killing nearly all plants with which it comes in contact. Glyphosate is useful in eradicating quackgrass, tall fescue, and other weeds that cannot be controlled selectively. The chemical has no soil persistence and treated areas can be tilled and reseeded 7 days after application.

Herbicide Formulations and Active Ingredients

The formulation of a herbicide is designated by a W,L,E,G, or DF in the product name. W refers to a wettable powder; L refers to a liquid (water dispersible suspension or water soluble liquid); E refers to an emulsifiable concentrate; G refers to a granular; DF refers to a dry flowable or water dispersible granule.

Herbicide recommendations are often given as pounds of active ingredient per acre or ounces per 1,000 square feet. The active ingredient (a.i.) is the part of a chemical formulation that produces herbicidal effects.

The numbers that precede the letter designation for formulation in the product name denote the percent active ingredient or pounds of active ingredient per gallon in the formulation. For example, a 5% granular formulation (5G) herbicide contains 5% active ingredients; 20 pounds of material are required to yield 1 pound of active ingredient. Treatment of 1 acre with a 5% granular herbicide at the rate of 2 pounds active ingredient per acre requires 40 pounds of granular material per acre, or approximately 0.9 pound of granular material per 1,000 square feet (1 acre = 43,560 sq. ft.).

Liquid formulations generally give active ingredients as pounds per gallon (lbs. a.i./gal) rather than as a percent of the formulation. For example, 2,4-D is generally formulated as 4 lbs. a.i./gal; therefore, an application of 1 pound per acre of this formulation requires 1 quart of liquid for each acre covered.

Sprayer Calibration

Compressed Air Sprayers

1. Measure 1,000 square feet of turf (a block 20 x 50 feet or equivalent), using twine to outline the block. (Most dosage recommendations are made for 1,000 square feet of area.)
2. Pour into the sprayer a measured amount of water (for example, 3 gallons).
3. Pump up the sprayer to a reasonable pressure. (On a 2- or 3-gallon sprayer, 40 to 50 full strokes of the pump are suggested.)
4. Open the cut-off valve and walk at a reasonable pace over the measured area until all the surface is covered.
5. Release the air pressure and measure the amount of water left in the tank.
6. Subtract the amount left in the tank (step 5) from the amount placed in the sprayer to find the amount used in spraying 1,000 square feet.

Example
If 3 gallons are put in a sprayer and 2 gallons are left, 1 gallon is used to cover 1,000 square feet.

The amount found in step 6 is the base for figuring how much chemical to use in each gallon of water when you actually spray. The actual amount of water used is not important, but whatever the amount, it must be a known quantity. If the suggested rate of chemical is 2 ounces per 1,000 square feet, you mix 2 ounces for each gallon of water the sprayer will hold. From our example, a 3-gallon sprayer will take 6 ounces of chemical. (Ounces per 1,000 square feet can be converted to pounds per acre by the factor 2.72; 2 ounces per 1,000 square feet x 2.72 = 5.41 pounds per acre.)

Dry Spreaders

1. Measure a runway 100 feet long. Multiply the width of the spreader by 100 to determine square footage of the test area.
2. Calculate the amount of material to be applied to this test area. (If test area is 300 square feet and label recommends 5 pounds per 1,000 square feet, the spreader should be calibrated to apply 1.5 pounds on test area.)
3. Tape a sheet of paper under hopper to catch granules. Allow enough clearance for the material to drop freely.
4. Open the feed and walk over the runway.
5. Carefully remove the paper and weigh the material caught under spreader.
6. Adjust spreader and repeat steps 3 through 5 until the proper amount (Step 2) is caught.

Note: In order to ensure uniform application, it is important for the applicator to maintain a steady walking speed.

General Considerations for Effective Herbicide Use

Most herbicides do not act immediately, and their effects may not be observed for several days or weeks. Herbicides should be applied at recommended rates to prevent burning off the above-ground plant tissue before the herbicide can be translocated into the root system. Lower rates with repeated applications are often most effective for controlling perennial weeds.

The use of 2,4-D in the vicinity of flower beds, ornamental shrubs, and home gardens may cause considerable damage. Amine and other low volatile formulations of 2,4-D and related herbicides are recommended for home lawns. Herbicides should be sprayed at low pressure during days of minimal or no wind to insure against drift.

Dicamba should be used only when it is necessary to kill a persistent weed species. Dicamba is active in the soil and should not be used within the root zone of trees and shrubs because injury may result. Restrict use to spot treatments.

Sprayer Care

Always drain and rinse the sprayer tank with water, then partially refill and flush through the nozzles after each spraying, regardless of the chemical used. To clean 2,4-D or other growth-regulator type herbicides, add detergent to the flushing solution or use a 0.3% activated charcoal suspension or a 5% household ammonia solution. Rinse sprayer for 2 to 3 minutes with the activated charcoal suspension. Allow detergents and ammonia solutions to stand overnight. Drain and rinse thoroughly.

A single sprayer should not be used for growth regulators, herbicides, insecticides, and fungicides. A separate sprayer should be used for herbicides, especially 2,4-D type herbicides.

Herbicides for Turf Use

The lawn weed control guides in the following sections provide the latest recommendations for chemical control of lawn weeds. Herbicide rate recommendations are given in pounds of active ingredient per acre (lb./a.i./acre). Read the label to determine the amount of product that should be used.

Particular attention should always be given to reading and following label instructions before a product is used. Only certified knowledgeable applicators may purchase and apply **restricted use pesticides.**

Annual grasses (crabgrass, foxtail, goosegrass)

Preemergence herbicides. For crabgrass and foxtail control, the following herbicides should be applied in April or early May before forsythia blossoms begin to fall. Applications for goosegrass control may be delayed 2 to 3 weeks. Only siduron may be used at the time of reseeding. These herbicides have no effect on established weeds; they must be applied prior to seed germination. These products are often available in combination with fertilizer products.

Chemical	Rate (lb. ai/A)	Remarks
benefin (Balan)	1.5-2	Not recommended for use on bentgrass. Do not reseed until at least 6 weeks after application.
bensulide (Betasan)	10-12.5	Do not reseed until 4 months after application.
DCPA (Dacthal)	10	Do not reseed until 60 days after application. Many DCPA products are cleared for use around ornamentals and garden plants.
oxadiazon (Ronstar G)	2-4	Do not use on zoysia or bentgrass. Do not apply to wet turf.
siduron (Tupersan)	2-12	May be used on newly seeded or established turf.

Postemergence control. The organic arsenicals, DSMA or MSMA (Ortho Crabgrass Killer, Bueno 6, Weed-E-Rad), are registered for control of crabgrass and other annual grasses after they have become established. Best control is obtained when applied while crabgrass is small and actively growing. A second application 7 to 10 days after the first treatment may be required for complete control. Temporary discoloration of turfgrass may occur.

Perennial grasses (tall fescue, nimblewill, quackgrass)

No selective herbicides are available for control of perennial grasses. Glyphosate (Roundup, Kleenup) can be used as a spot treatment to control weedy grasses—glyphosate will also kill the desirable turfgrass. Apply Roundup at rate of 1 to 3 lb. ai/A or as a 1 to 1.5% solution for spot treatment.

Annual and perennial broadleaf weeds

2,4-D, MCPP, and dicamba are the most commonly used herbicides for broadleaf weed control. These chemicals are similar in activity, but vary slightly in their spectrum of control. Care must be taken to avoid contacting ornamentals or garden plants with these compounds. Most products available to the homeowner consist of a mixture of two or three of these products. If a combination of growth regulator herbicides is used, the amount of the individual products is normally reduced.

Chemical	Rate (lb. ai/A)	Remarks
2,4-D	1-1½	Do not use on bentgrass at rates used when applied alone. Amine formulations are less volatile than esters which reduce risk of injury to nearby nontarget plants. Effective against dandelions and plantains.
MCPP	1-2	Chemically related to 2,4-D, except more effective against chickweed and certain other broadleaves. Safer on bentgrass than 2,4-D. Usually sold in combination with 2,4-D.
2,4-DP	¾-1	Normally sold in combination with 2,4-D. Products containing 2,4-DP are for use by professional personnel rather than homeowners.
dicamba	¼-1	Used for control of weeds tolerant to 2,4-D and MCPP. Dicamba is highly volatile and injurious to ornamental plants. Avoid application under drip lines of trees. Usually applied in combination with 2,4-D and/or MCPP to allow reduction of rate.
bromoxynil (Brominal ME4 or Buctril 2E)	0.37-0.5	Bromoxynil is a contact herbicide effective only against small annual broadleaf weeds. May be used on seedling turf when turf height exceeds 2 inches.

The following products contain a mixture of two or three of the above herbicides. These combinations provide a broader spectrum of weed control than obtained with a single product. Combinations also allow reduction of rates of the individual herbicides that may decrease risk of damaging turf or nearby ornamentals.

2,4-D + MCPP	(Weed-B-Gone)
2,4-D + MCPP + dicamba	(Weed-No-More, Spectrum 33 Plus, Trimec Broadleaf Herbicide)
2,4-D + 2,4-DP	(Weedone WPC)
2,4-D + 2,4-DP + dicamba	(Trimec Turf Ester)

Yellow nutsedge

Yellow nutsedge is a perennial with a growth habit similar to grasses. It can be distinguished from grasses by its triangular stem. Best results are obtained if treated while small and actively growing.

Chemical	Rate (lb. ai/A)	Remarks
bentazon (Basagran)	1-2	Apply before nutsedge reaches 8 inches in height. Repeat applications probably will be necessary. Basagran is not widely available to the homeowner.
DSMA	2	Apply while nutsedge is small and actively growing. Repeat applications will be required. Better control may be obtained when applied in combination with 2,4-D.

Weed Response to Broadleaf Herbicides.[1]

	chickweed, common	chickweed, mouseear	clover, white	dandelion	ground ivy (creeping charlie)	knotweed	medic, black	plantain, broadleaf, and buckhorn	speedwell	spurge
Life cycle[2]	A	P	P	P	P	A	A	P	A,P	A
2,4-D[3]	F	F	P	E	F	F	F	E	P	P
2,4-D + 2,4-DP	E	E	G-E	E	F-G	G	G	E	F	G-E
MCPP	E	E	G	F	F	F	G	F	P	P
dicamba	E	E	E	F	F-G	G-E	G	F	F-G	F
bromoxynil	G	P	P	P	P	G	G	P	F-G	G

[1]Control: P = Poor, F = Fair, G = Good, E = Excellent

[2]Life cycle: A = Annual, P = Perennial.

[3]2,4-D, MCPP, and dicamba may be purchased separately or in pre-mixed combination products. 2,4-DP is only available in combination with 2,4-D.

Broadleaved Weeds

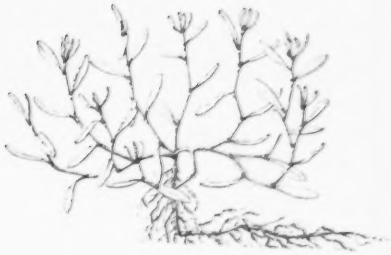
Black Medic

Woodsorrel

White Clover

Common Chickweed

Mouseear Chickweed

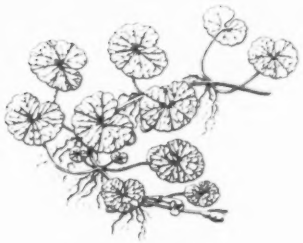


Knotweed

Thyme-Leaf Speedwell

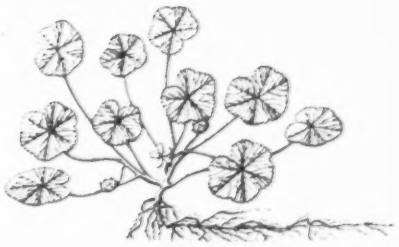
Corn Speedwell

Henbit



Ground Ivy
(Creeping Charlie)

Field Bindweed
(Creeping Jenny)



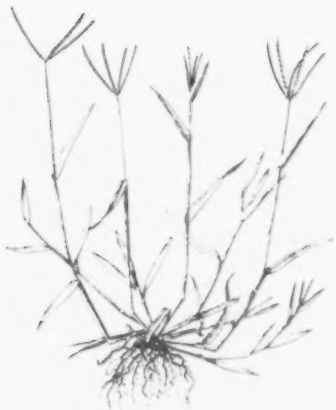
Common Mallow

Broadleaf Plantain

Lambsquarters

Buckhorn Plantain

Annual Grasses



Crabgrass

Goosegrass

Foxtail

Perennial Grasses

Quackgrass

Nimblewell

Sedges

Yellow Nutsedge

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horticulture guide

Warm season annual grass weed control in lawns

There are three warm-season annual grasses that are generally problem species in Iowa lawns. They are crabgrass, foxtail, and goosegrass. To control them involves the understanding of the following:

* Weeds life cycle.
* Environmental conditions that influence weed growth.
* Cultural practices that affect weed growth.
* Herbicides used to control the weeds.

Being an annual, each grass will complete its life cycle in one year. They reproduce by seed from late spring through the summer. Each will die with the first killing frost.

Being a warm season plant, they grow vigorously throughout the summer, and growth slows or stops during cool weather in the late summer and early fall.

Crabgrass (Digitaria sp.): Crabgrass is the most prevalent annual grass weed found in Iowa lawns. There are two species of crabgrass that are found in the lawn: smooth crabgrass (Digitaria ischaemun) and large crabgrass (Digitaria sanquinalis). Smooth crabgrass tends to be smaller, less hairy, and has a purplish color on the stem. Both species have a light green color and a prostrate growth habit which roots at the nodes. Seedheads will appear as finger-like projections at the top of the upright stem. Seeds of both species will begin to germinate when the soil temperatures reach 55 to 60°F. This is generally mid-April in southern Iowa, early May in central Iowa, and mid to late May in northern Iowa. Moisture and light are both required for germination and growth and crabgrass infestations are generally limited to sunny areas in the lawn.

Foxtail (Setaria sp.): There are two species of foxtail which can be found in the lawn: yellow foxtail (Setaria lutescens) and green foxtail (Setaria viridis). Yellow and green foxtail are often mistaken for crabgrass in the early stages of growth. They can be distinguished from crabgrass by their bunch-type, semi-erect growth habit. Yellow foxtail is more persistent than green foxtail and occurs mostly in newly seeded lawns. Foxtail seeds germinate when soil temperatures reach of exceed 65°F. This is generally one to two weeks later than crabgrass seed germination. While germination is best when light and moisture are present; the light criteria is not as important as it is for crabgrass since foxtail will invade thick, dense lawns.

Goosegrass (Eleusine indica): Goosegrass or silver crabgrass has a prostrate growth habit that does not root at the nodes. Growth occurs as a rosette of thick stems with a whitish basal area. Seedheads occur as spikes that radiate from the top of the stem. Goosegrass seeds germinate when the soil temperatures reach 60 to 65°F. This is generally one to two weeks later than crabgrass seed germination. Goosegrass requires light and moisture for germination and growth. It is most competitive in thin open turfs that are subjected to intense traffic and is a good indicator of compacted soils. Goosegrass is mostly found in the southern part of Iowa.

Cultural practices which enhance warm season annual grass weed competition include close mowing, summer fertilization, and frequent irrigation. **Close mowing** weakens the turf and opens it up to light penetration, thereby increasing the incidence of weed germination. As a general rule, mow Kentucky bluegrass lawns at 2 to 3 inches on a weekly basis. It is important to

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remove no more than one-third of the leaf area with any mowing. **Nutrients applied during the summer months** are used more by the weeds and less by the desirable turfgrass species. These weeds are warm season plants, thus they grow best during the summer months. Kentucky bluegrass is a cool season species. It grows best during the spring and fall. For proper fertilization, the reader is referred to Pm-1057, Maintenance Fertilization of Turfgrasses. **Light frequent irrigation** not only encourages weed seed germination but also a shallow root system. A plant with a shallow root system is more prone to environmental stresses. Since the desirable turfgrass species are cool-season species, they will be less competitive during the summer. Irrigating deeply and infrequently encourages a deep root system which will enable the desirable turfgrass species to be more competitive.

Warm season annual grass weeds can be controlled preemergently and postemergently. The preemergence herbicides that are labeled for annual grass weed control are listed in Table 1. These chemicals need to be applied prior to weed seed germination. It is important to water in the herbicide, which results in a chemical barrier to seed germination. For continual control, benefin and DCPA may require a second application at half rates 5 to 6 weeks after the initial treatment. Bensulide and DCPA can be applied to a turf that was established the previous fall, while oxadiazon and benefin should only be applied to established lawns. Benefin, DCPA, and oxadiazon should not be used on bentgrass. In addition, some preemergence herbicides have shown injury to fine fescues. The herbicide effectivenss may be decreased by excessive rainfall.

The postemergent herbicides which are labeled for warm season annual grass weed control are the organic arsenicals (Table 2). Best control is obtained when applied while plants are small and actively growing. A second application 7 to 10 days after the first treatment may be required for complete control. Treatment should be made on days when the temperatures will not exceed 85°F. Even so, some discoloration of the desirable turf may result from application. When temperatures are below 80°F, rates need to be increased.

One final note -- postemergence herbicides are less effective and harder to use than preemergence herbicides.

Table 1. Preemergent herbicides for annual grass weed control.

Chemical Names	Brand Name(s)
Benefin	Balan
Bensulide	Betamac-4 Betasan Lescosan Pre-san
DCPA	Dacthal
Oxadiazon	Ronstar-G
Pendamethalin	Proturf Weedgrass Control

Table 2. Postemergent herbicides for annual grass weed control.

Chemical Names	Brand Name(s)
DSMA	Ansar DSMA liquid DSMA 81% Methar 3D Weed-E-Rad
MSMA	Ansar Ansar Broadside Weed-Hoe

Prepared by Michael Agnew, extension turfgrass specialist.

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horticulture guide

Seeding the lawn in spring

When possible lawns should be seeded in the fall. However, there are circumstances which warrant spring seeding. For instance, the owner of a newly completed home may not want to wait until fall to seed the lawn.

Most of the species that we use as turfgrasses in Iowa are cool season grasses. They are grasses which do best when temperatures are on the cool side, from 60 to 75°F. These grasses will grow when temperatures reach 90° and above, but their rate of growth will be greatly reduced. They will also become established after seeding much more rapidly if temperatures are cool.

In Iowa, suitable temperatures for the growth and development of cool season grasses occur in the spring and fall. While the best time to seed is in the late summer and early fall, seeding is possible in spring. However, it is generally not recommended. The reasons for this are based primarily on soil temperature differences between spring and fall and on the differences in the type of weed infestations which occur in the two seasons. Iowa soils are also easier to work with in fall than in spring.

Seeds require a certain minimum soil temperature before they will germinate. For the cool season turfgrass species, this temperature is approximately 55-59°F. In the late summer and early fall, soil temperatures are generally higher than 55°F and usually do not go below that temperature until late in the fall. This means that seeds planted in late summer, if given sufficient moisture, will germinate rapidly and will have a long period of suitable temperatures to become well established. In spring, soil temperatures are generally below 55°F and do not warm up to this minimum temperature till mid to late May. Seeds germinate slowly in the spring and have only a short period of ideal temperatures before summer heat stress begins.

When a turfgrass area is seeded, it is generally assumed that the best possible conditions will be provided for the germination of seed. It should be remembered, however, that the best conditions for the germination of turfgrass seeds are also generally the best conditions for the germination of many problem lawn weeds. The weed species which have seeds that germinate in the fall are primarily broadleaves. These weeds can be removed from turfgrass areas with selective postemergent herbicides such as 2,4-D as soon as the turf is fully established. The weed seeds which germinate in the spring are those of the grassy annuals such as crabgrass and goosegrass. If these weeds become established in the spring, you have to put up with them until the next season.

Procedure for Spring Seeding

1. **Obtain a soil sample and have it tested** for pH, phosphorus (P), and potassium (K). Then add fertilizer according to the recommendations on the soil test report. If a soil test is not possible, add 2 lbs each of nitrogen, P_2O_5, and K_2O/1000 sq ft. Till the fertilizer into the upper 4-6 inches of the seedbed.
2. **Level the seedbed and apply additional fertilizer** at a rate of 1/2 lb of nitrogen and 1 lb P_2O_5/1000 sq ft to the surface. (Any good starter fertilizer, used as directed, will be suitable.)
3. **Apply the seed** to the soil surface at a rate approximately 25% above the standard recommended rate for that species. **Example:** For a Kentucky bluegrass lawn, the standard recommendation for seeding would be 1 1/2 lb/1000 sq ft. For a spring seeding, use

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2 lbs/1000 sq ft. Kentucky bluegrass seed will not germinate until soil temperatures have reached a minimum of 59°F.

4. **Mulch the area with clean (weed free) straw.** This will help keep the soil moist, conserve moisture, and prevent erosion. One bale of straw per 1000 sq ft will give a light mulch covering that will not have to be removed after germination.

Remember that the soil is going to have to warm up to at least 55-59°F before the seed will germinate. Seed planted in early April will germinate no sooner than seed planted in early May.

An additional precaution that should be taken with spring seeding is to use the herbicide siduron, which is the active ingredient of many crabgrass preventer/starter fertilizer materials. Siduron is a member of a group of preemergence herbicides which have the capability of killing seedlings of such species as crabgrass as they emerge from the soil in the spring without damaging the germinating turfgrass seedlings. Unfortunately, most of these preemergents kill the seeds of the cool season turfgrasses and cannot be used at the time of seeding. Siduron is the only exception. Siduron can be applied with bluegrass, fescues, and ryegrass at the time of seeding. The seedlings of crabgrass, foxtail, and barnyard grass will be selectively controlled and the desirable grasses will remain unaffected. Siduron should be applied at the time of seeding, prior to mulching, and should be activated with 1/2 inch of water within 3 days of application. Once the barrier of siduron has been established, the soil should not be further disturbed. Wherever the barrier is broken, annual weeds will emerge.

Prepared by Nick Christians, associate professor, and Michael Agnew, extension turfgrass specialist.

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